A SOCIAL HISTORY OF THE PEACH PALM (*BACTRIS GASIPAES*) IN SOUTH AMERICA

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TC 660H
Plan II Honors Program
The University of Texas at Austin

May 13, 2020

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ABSTRACT

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Genetic, linguistic, and cultural clues about domesticated plants provide insights into the histories of the people who have developed and used them. This study examines these clues for the peach palm (*Bactris gasipaes*), a fruiting palm that is native to South America, but was domesticated and dispersed more widely around the continent by indigenous peoples prior to European arrival there. This project interprets the distribution of peach palm terms in indigenous South American languages in comparison to both genetic work on wild and domesticated peach palm varieties (Clement et al., 2017) as well as ethnographic work and historical information on the significance of the peach palm in different indigenous groups. In its linguistic component, this project analyzes lexical data in South American indigenous languages using dictionaries, other published materials, and communication with experts. Ethnographies of indigenous groups illustrate the ceremonial and ritual uses of the peach palm, and may provide additional information about the distribution of peach palm use practices. Finally, this project examines the peach palm's status in the context of its historical trajectory to identify possible explanations for its lack of global importance, especially compared to other New World crops. By drawing on data and analysis from multiple fields, this project aims to look toward a more complete picture of the peach palm and the people who have used it over time.

ACKNOWLEDGMENTS

I am so grateful to Dr. Patience Epps, who in addition to advising this project, has been my research advisor for the last three and a half years. Her guidance and support in research, classwork, and everything else has made my time at UT far more interesting and valuable to me, and I am certain I would not be on the educational and professional path I am on without her. Thank you also to Dr. Lina del Castillo, whose class inspired me to study both history and archives and use them together to create fun and engaging academic scholarship. That class, as well as all her guidance on helping me formulate this thesis into a multidisciplinary project, has been invaluable.

Thank you to my parents for always encouraging me to do whatever I am interested in, regardless of how often it changes, for listening to my stream-of-consciousness ramblings about languages and plants and maps, and for always giving me all the love and support I could ever need. To my siblings, grandmother, and extended family, thank you for asking and being willing to hear about my ever-changing interests and always being around to take a break from school with. To my friends, thank you for many, many, many game nights and arguments, and for learning more than you ever want to know about the peach palm and Dr Pepper. To all my other professors, work supervisors, and coworkers, I am so appreciative of the time I was able to spend in classes and offices with you, and I know that each of those experiences was important in its own way to where I am today. I'm especially grateful to the Plan II Honors Program, Linguistics department, and Spanish & Portuguese department for all their work in giving me and other students a challenging but supportive environment to grow in while here at UT.

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1. Introduction

It is not possible to fully reconstruct the histories of a people or place, certain "things" that people have used, grown, and created throughout time are found in contemporary language, cultural traditions, and recorded history. People may continue to use and value these items for long stretches of time, and the items may remain regionally important, despite a lack of any greater global significance. These remnants in the modern record can shed light on things and concepts that were relevant to people in the past. In the case of domesticated plants, information about the histories of how people have come to know, interact with, and value different plants exist in the aforementioned realms, as well as the scientific record. Plant biology traces the wild variety origins as well as the relative time and geographic space in which a plant was domesticated, and proposes hypotheses for how domesticated plants came to exist in their modern geographic distributions. By using plants as a key focus of study as a "thing" traced throughout the history of a people or region, unique insights are created, because evidence can be drawn in from typically unrelated disciplines. In this project, I examine the social history of one plant, the domesticated peach palm (*Bactris gasipaes*, Portuguese: *pupunha*; Spanish: *chontaduro, pijuayo*, among others), tracing its dispersal throughout South America using genetic, linguistic, ethnographic, and historical evidence.

In studying the peach palm, this project seeks to investigate the links between agricultural spread and cultural diffusion. While genetic studies offer insight about the initial domestication of the peach palm, as well as its primary directions and paths of dispersal, they cannot shed light on the motivations for this dispersal, or who the major dispersers of the plant may have been. By examining linguistic data for the peach palm terms across indigenous South American languages for evidence of terms which reconstruct to protolanguages and borrowings across language

families, this project will present hypotheses for language groups which may have played a significant role in peach palm dispersal. To better understand some of the possible motivations for peach palm dispersal, this project will examine the ethnographic record as it pertains to the peach palm. The cultural traditions, ceremonies, and local stories associated with the peach palm in different communities and the similarities in these across communities point to a common point of entrance for the peach palm into some communities—the creation of a fermented peach palm drink and celebration of a related ceremony. Finally, this project turns toward the peach palm fruit's modern position, as a regionally important food in Amazonia and other parts of South America, but nearly unknown outside South America. By using historical scholarship and economic studies about the peach palm fruit's potential as a global export, this project will investigate how the peach palm differs from other New World crops which have become global food staples, such as the sweet potato and cassava.

In its linguistic component, this project examines the distribution of peach palm terms across indigenous South American languages. In particular, the analysis identifies two types of linguistic relationships among terms across different languages: loans and reconstructions. By examining how terms relate to one another within language families as well as across them, this project looks toward a relative chronology of peach palm dispersal among South American languages, which correlates with its geographic spread. In addition, evidence of polysemy and semantic shifts in forms from a different meaning to 'peach palm' or vice versa may point to a common cultural relevance of the peach palm in different language groups. This additional form of linguistic evidence may also suggest how the peach palm may have spread through different language groups. Linguistic evidence, which uses modern data to look to the past, and can be

considered in a geographic context, is this project's primary tool to create a relative timeframe of peach palm dispersal in South America.

Turning to ethnographic studies, this project examines the cultural relevance of peach palm as a possible motivation for its dispersal among different groups. Using published ethnographies of indigenous communities in South America, this project identifies possible shared cultural traditions associated with the peach palm, such as festivals celebrating the peach palm's fruiting season, and peach palm fruit fermentation. Where similar ceremonial and ritual practices associated with the peach palm exist across different groups (and possibly in a wide geographic distribution), it may suggest that the diffusion of these practices occurred alongside the dispersal of the peach palm, and motivated it. Ethnographic sources provide context to the path and relative chronology proposed by biological and linguistic angles by offering insight into the social significance of the peach palm as it was being dispersed around South America.

Finally, this project turns toward the peach palm's present situation in South America, as a regionally important food source and useful plant, especially for indigenous communities, without a global profile as a food export. When considered in comparison to other New World crops—crops native to South America which became global products—the peach palm has the nutritional and agricultural profile to be globally significant, but is not. Using historical scholarship on the peach palm in the early colonial period in Latin America, as well as modern economic and agricultural reports, this project will consider the factors that may have prevented the peach palm's global popularity. By examining the more recent record of peach palm development use, as well as the attitudes and obstacles which may have precluded the peach palm from reaching a status like that of the sweet potato, this project will consider how the peach palm's local importance is placed in a global context.

Together, these linguistic, ethnographic, and economic lenses create a more complete picture of how the peach palm has been and continues to be of social significance in South America. The social history of the peach palm can also shed light on broader histories of movement and interaction among people in South America, because it can point to groups which may have been important in the operation of trade networks.

Due to the nature of the different types of evidence used in this project, the time frame considered ranges from pre-Columbian (about 3500 years before present) to present day. The 3500 BP figure is derived from the oldest tentatively-proposed last date spoken of a protolanguage considered in this project. For the purposes of this project, this is the approximate possible date of the last time Proto-Tupian was spoken, and is assumed to represent a time at which peach palm dispersal was happening, possibly in its early stages.[1] In addition, 4000 to 3000 BP has been proposed as the time frame in which food production systems started supplying significant portions of human diets.[2] This project also assumes that peach palm dispersal would not have taken place much before food production systems were important. In considering the trajectory of peach palm dispersal itself, this time frame extends to European arrival in South America in the late 15th century, as genetic work indicates that much of peach palm dispersal occurred prior to European contact.[3] However, to consider the peach palm's lack of modern global popularity, this project also looks at the period ranging from after European arrival to present, particularly the early years of European colonialism and present day. The timeframe for this project is segmented by the different approaches taken, as no one method

[1] Brown et al., The paleobiolinguistics of domesticated manioc (Manihot esculenta), 2013.
[2] Brown et al., The paleobiolinguistics of domesticated manioc (Manihot esculenta), 2013.
[3] Clement et al., 2017.

ranges the full period. Instead, the different methods permit the construction of a longer timeline to trace the social history of the peach palm.

By triangulating among these linguistic, ethnographic, historical, and genetic clues, this project will argue that domesticated peach palm dispersal in South America was motivated by ceremonial culture, such as festivals and beer-making, rather than just subsistence. Although peach palm fruit are both edible and eaten by many people in South America, linguistic and ethnographic evidence suggests that the surrounding context of peach palm celebration may have caused people to carry and share the peach palm around South America. This paper will additionally present evidence that Arawakan speakers may have been some of the primary dispersers of the peach palm, on the basis of linguistic evidence and the distribution of similar cultural traditions involving the peach palm. The following chapters will examine each type of evidence in detail in order to build on this paper's central arguments.

This project is organized into four primary parts. The following chapter discusses the necessary background for this project, including an overview of the peach palm's profile, the genetic work on the origin and dispersal of the peach palm, Amazonian crop diversity, other linguistic prehistory studies in South America, and linguistic diversity and typology in South America relevant to this project. Chapter three examines the lexical evidence for peach palm spread, including reconstructed peach palm terms, possible borrowings, and forms which refer to both the peach palm and one or more other things or concepts. This chapter will build on genetic evidence for the peach palm's spread by discussing particular language families whose speakers may have had a significant role in dispersing the peach palm. Chapter four turns to the ethnographic record of indigenous groups in South America, and uses them to identify cultural and ceremonial uses of the peach palm. This chapter argues that the frequency of peach palm

festivals and ceremonies which involve beer-making may suggest that these uses motivated its dispersal. Chapter five examines the contemporary use and profile of the peach palm, particularly its lack of global importance, and its historical trajectory relative to other New World crops. The goal of this chapter is to investigate what factors differentiate the peach palm from other New World crops which have become global products, as well as identify any possible relationship between the peach palm's historical and contemporary local uses and its lack of use outside of South America. Chapter 6 draws conclusions from the previous three chapters to build up this project's central argument that fermentation and ceremonial use was a major factor in pre-Columbian domesticated peach palm dispersal in South America.

2. The peach palm in linguistic, historical, and ethnographic context

Introduction

This project builds on prior work on the peach palm's history and genetic dispersal, and so this chapter will lay the foundation for this project's goal of investigating the social history of the peach palm by offering an overview of prior work on the peach palm, other relevant background information, and the methodological approaches to be used in this project. This chapter outlines the relevant genetic and social details of the peach palm, including some of the palm's functional and cultural uses. It also summarizes work on domesticated crop distribution in Amazonia at the time of European contact, as well as the significance of certain products, like beer, as possible motivators for crop dispersal. Next, this chapter turns to a review of other literature which has undertaken studies similar to this one, with an emphasis on pre-Columbian, Amazonian crops, in order to classify the methodologies used to approach linguistic crop history. Finally, this chapter offers an overview of some of the linguistic work on South America's features which allow for socio-cultural reconstruction through a linguistic lens, including typological work relating to grammatical features, proposed linguistic homelands for certain language families, and movement and contact patterns of speakers of languages in some language families.

Bactris gasipaes (Peach palm)

Bactris gasipaes, known in English as the peach palm (Portuguese: *pupunha*; Spanish: *chontaduro, pijuayo*, among others) is a fruiting palm native to the Neotropics, which has been domesticated by indigenous peoples and today grows in a wide distribution across South America.[4] Clement et al. (2017) identifies and names three types of the wild *chichagui* variety,

[4] Clement et al. 2017, 2-3.

with types 1 and 3 growing across southern and southwestern Amazonia, and type 2 growing in northern South America only. Type 3, which differs from types 1 and 2 in that it can produce a variety of fruit sizes from relatively small to very large, has been identified by Clement et al. (2017) as the incipient domesticate for cultivated peach palm. This domestication occurred while *chichagui* var. 1 and var. 3 were in sympatry, meaning they were in overlapping geographic distribution in southwestern Amazonia near the modern-day shared border of Brazil, Peru, and Bolivia. The newly domesticated variety was subsequently dispersed around South America. While past work on domesticated peach palm has suggested that it exists as a result of many independent, geographically distant domestication events, Clement et al. (2017) indicate that the area of sympatry between the *chichagui* varieties 1 and 3 is the only likely area in which the incipient domesticate could have existed, as proven by its ecological adaptations and hybridizations with wild varieties.

Clement et al. (2017) propose that, from its initial domestication locus in southwestern Amazonia, the peach palm had two major directions of dispersal: to the west, along the upper Ucayali river basin, and to the east, along the Madeira river.[5] Major contrasts between the peach palm fruit which resulted from these two dispersals include fruit size and starch content, with larger, starchier fruit typically found in western Amazonia, and smaller, more oily fruit found in eastern Amazonia. The western dispersal, which likely generated starchy peach palm fruit early on, moved along the Ucayali and Amazon rivers into northwestern Amazonia, where larger varieties of starchy peach palm fruit continued to develop.[6] Clement et al. note that the starchy fruit is easier to ferment and that fermentation is a common way to prepare the peach palm in western and northern Amazonia. Clement et al. propose that fermentation of starchy peach palm

[5] Clement et al. 2017, 15.
[6] Clement et al. 2017, 14.

fruit drove the development of larger fruit found primarily in western Amazonia. The eastern dispersal moved along the Madeira river toward eastern Amazonia, primarily in contemporary Brazil. In contrast to the western dispersal, the fruit developed in the eastern dispersal did not result in especially starchy or large fruit, and Clement et al. suggests that the fruit in the region where this dispersal occurred may have been used primarily as a snack food.[7]

The resulting domesticated *gasipaes* variety has today been classified into three major landraces based on fruit size, the small microcarpa, medium mesocarpa, and large macrocarpa.[8] Clement et al. finds that the mesocarpa and macrocarpa are larger as a result of selection for starchy fruit over oily fruit, and are primarily found in western South America, as well as Central America.[9] The microcarpa, which contain more oil and less starch, are found primarily in eastern Amazonia. *Figure 1*, which is a reproduction of the map in "Origin in Dispersal of Domesticated Peach Palm" by Charles Clement et al. (2017), shows an overview of the wild and domesticated peach palm varieties and paths of dispersal identified by Clement et al.

[7] Clement et al. 2017, 15.
[8] Clement et al. 2017, 3.
[9] Clement et al. 2017, 14.

Figure 1. Distribution of wild populations and domesticated landraces of peach palm (*Bactris gasipaes*), reproduced from Clement et al. (2017)

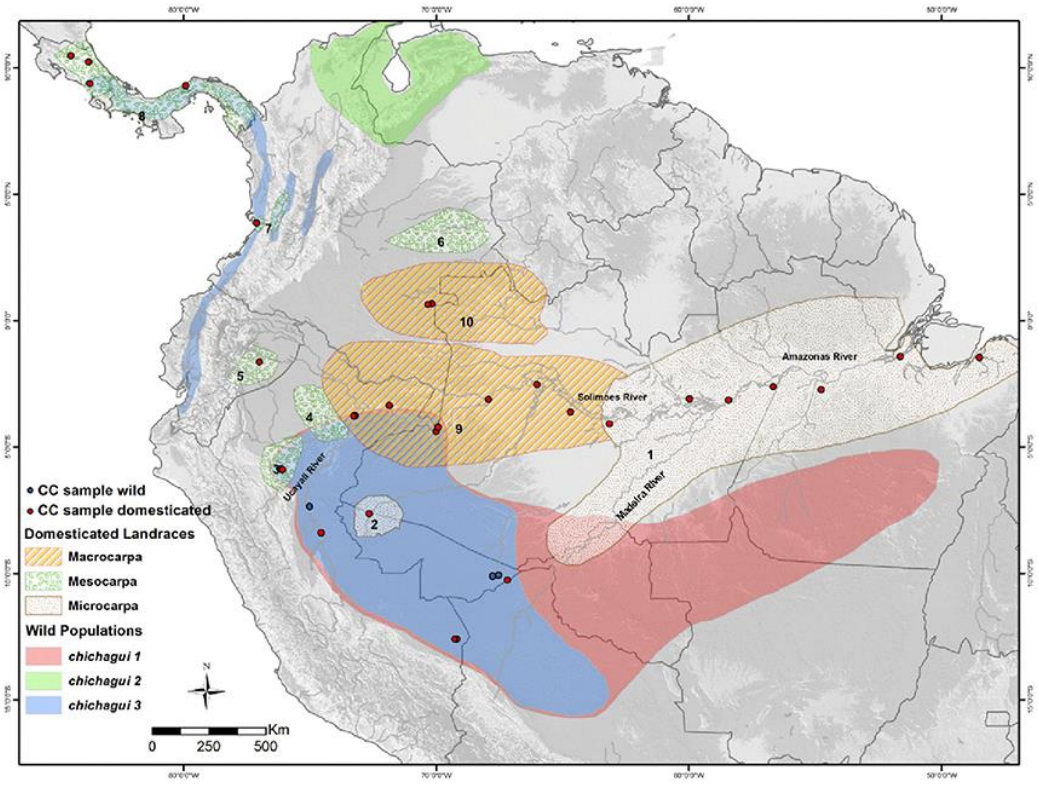


Figure 1. Distribution of wild populations (var. *chichagui*, types 1, 2, and 3; following Clement et al., 2009b) and domesticated landraces (var. *gasipaes*; following Clement et al., 2010) of peach palm (*Bactris gasipaes*) once represented in the Peach palm Active Germplasm Bank at the Instituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, Brazil. Core Collection (CC) samples within the Peach palm Active Germplasm Bank (Cristo-Araújo et al., 2015) are identified with blue dots (wild samples) and red dots (domesticated samples). Landrace distributions are in differentially textured areas and numbered: microcarpas (1) Pará and (2) Juruá; mesocarpas (3) Pampa Hermosa, (4) Tigre, (5) Pastaza, (6) Inirida, (7) Cauca and (8) Utilis; macrocarpas (9) Putumayo and (10) Vaupés. See Hernández-Ugalde et al. (2011) for other landraces and populations. [Caption reproduced from Clement et al. (2017).]

The fruit of the peach palm is a nutritious food source especially popular among indigenous communities in Central and South America where the palm grows. The starchy fruits are a common snack item and can be fermented for beer-making. Depending on the variety, fruits can be rich in oil or starch, both of which provide energy.[10] Both the nutritional profile and

[10] Clement et al. 2004, 196.

texture are similar to the sweet potato. The peach palm cannot be eaten raw, and the fruit are usually boiled to be eaten, preserved, or used to make other products.[11] The boiled fruit alone are a popular snack food.[12] Additionally, boiled peach palm fruit is commonly fermented to make beer. The boiled fruits are mashed and chewed to produce pulp, which is fermented, then mixed with water to produce a drinkable alcoholic beverage.[13] The peach palm pulp and dried peach palm are more stable products than the raw fruit,[14] and can be preserved longer than the three to seven days that the raw fruit lasts.[15]

Peach palm beer-making is often associated with celebrations which mark the peach palm fruiting season. Different indigenous peoples perform celebratory ceremonies, often with dances, special clothing, and masks, which begin when the peach palm fruiting season begins.[16] These festivals include different preparations of peach palm beer, as well as the preparation of non-fermented peach palm juice, as in the case of the Makuna in the Colombian Amazon. Some groups connect fertility to the peach palm fruiting season, as some festivals celebrate crop and animal fertility, and some festivals may bring on an increase in the number of children conceived. These traditions and beliefs and others will be discussed in the fourth chapter, on the ethnographic record related to the peach palm.

More recently, peach palm has become commercialized for heart-of-palm production. Also known as *palmito*, heart-of-palm is marketed as a gourmet vegetable for use in various dishes, as well as a snack food.[17] Peach palm plantations for *palmito* production now exist in a number of Central and South American countries, including Costa Rica and Brazil, as well as

[11] Mora-Urpí et al. 1997, 20.
[12] Smith 2015, 178.
[13] Smith 2015, 186-7.
[14] Mora-Urpí et al. 1997, 20.
[15] Clement et al. 2004, 197.
[16] Smith 2015, 188-9.
[17] Mora-Urpí et al. 1997, 24.

other areas including Indonesia and Hawaii.[18] Heart-of-palm is both an export product as well as a domestic one, particularly in Brazil. While heart-of-palm harvests have historically come from wild palms, cultivated peach palm has become a more stable and higher quality choice, leading to an increase in the number of peach palm plantations.[19]

Peach palm stems and their wood also have a variety of non-food uses. Indigenous peoples across South America have used and continue to use peach palm wood for creating weapons, building materials for homes, and fashioning other tools.[20] The wood, which is dense and strong, is useful for arrows and bows, as well as blowguns made out of whole stems.[21] Other tools created using peach palm wood include batons for stirring, mortars, and fish traps. While peach palm wood is primarily used in areas where it grows, rather than as an exported product, it is multifunctional for the people who use it.

Pre-Columbian Amazonian crop diversity

Clement (1999a) estimates that at first European contact in Amazonia, there were 138 crops being cultivated, managed, or promoted by people living in the region, spanning 44 botanical families.[22] While Clement does not quantify the losses in crop diversity when comparing pre-Colombian and post-contact Amazonia, he correlates the estimated 90-95% human population loss in the Neotropics as a result of European contact in the Americas with a decrease in crop diversity. Clement argues that with the decline in human populations and loss of whole communities, domesticated and managed crops were unable to survive without human intervention. Many of these species died out entirely, while others lost unique genetic varieties within their species. Clement notes that for most Amazonian crops, it is not known what their

[18] Smith 2015, 190-1.
[19] Mora-Urpí et al. 1997, 59.
[20] Smith 2015, 184. Mora-Urpí et al. 1997, 25.
[21] Smith 2015, 192.
[22] Clement 1999a, 192-5.

degree of intra-species diversity was prior to European contact. *Bactris gasipaes* is one of the few exceptions, as its genetic profile has been studied in more detail as a result of efforts to study key crops' genetic profiles by the Brazilian government in the 1980s. Other plant species domesticated in Amazonia prior to European contact include manioc, sweet potato, cacao, and other fruit trees and palms.[23] Many of these crops have maintained both their sociocultural significance as well as their usefulness as food and construction resources, peach palm included.

The long history of the peach palm's social and subsistence uses, combined with its wide distribution from an initially-localized domestication locus, suggests that its human-directed dispersal was motivated by its use. Sherratt (1995) suggests that products like beer which intoxicate the consumer are often shared cross-culturally, perhaps more so than food.[24] Clement et al. (2017) argues that because practices of peach palm beer-making, in addition to the plant itself, are found in wide distribution, beer-making was likely one motivation for the dispersal of the peach palm to different indigenous peoples in South America.[25] Beyond its use as a food source, the starchy varieties of peach palm are well suited for fermentation, and the development dispersal of large peach palm fruit varieties found in western Amazonia were likely driven by selection for starch. The technology of creating beer out of peach palm may have been just as valuable as the plant itself to pre-Columbian indigenous peoples.

Exploring the prehistory of crops in South America through language

To look toward a fuller image of the prehistory of a region, the people who live there, and its plant life, historical linguistics can offer insights about the relationships between people and different crops. South America, as a linguistically and agriculturally diverse region, has been the

[23] Clement et al. 2015, 2.
[24] Goodman, Lovejoy, & Sherratt, 1995.
[25] Clement et al. 2017, 14-15

site of multiple studies connecting distributions of plant terms with the distributions and movements of the plants themselves. Linguistic methodologies like comparative reconstruction and analysis of borrowings combine with a crop's established genetic profile, among other sources, to trace a possible trajectory of a plant's spread across a geographic region. One such method compares reconstructions of a plant's terms for various protolanguages in order to place a relative chronology of when the plant may have been introduced to speakers of those protolanguages. In addition, some studies use date-generating algorithms to attach estimated dates to this chronology. A second method analyzes evidence of loanwords across languages in order to trace both the movements of the plant and the histories of interaction among speakers of these languages. This section offers a methodological overview and a discussion of previously published studies which use methods similar to this project, including reconstruction and loanword approaches to linguistic prehistories. The studies use these methods and others to reconstruct (pre-)histories of pre- and post-Columbian elements (such as plants, animals, and objects) in South America, and provide an important foundation for the approach taken in this study. Each one uses the linguistic history of the things studied to make unique arguments about their distribution in South America, the interactions of the people who have used them, and/or their existence in South America at the time of European contact.

The reconstruction approach to linguistic prehistory rests on the assumption that terms that reconstruct in both form and meaning to a language family's protolanguage indicate that the concept signified by the term was familiar to speakers of the protolanguage.[26] Additionally, because a reconstructable term exists in the daughter languages, the concept is likely to have been salient over time for speakers of those languages, meaning the term is used often enough to

[26] Epps 2015, 580.

be resistant to replacement by another term. Plant terms in particular have been found to be resistant to replacement if they are frequently used by speakers of a language.[27] However, a term that does not appear to reconstruct for a protolanguage does not entail that the concept signified by the term was totally unknown to speakers of the protolanguage, as there are several possible explanations for the lack of a reconstructable term. Lexical replacements can occur for many reasons, and in a shallow language family, several replacements can obscure a reconstructable term. Despite these caveats, the lack of a reconstructable term may also indicate that the concept was introduced to speakers of the protolanguage's daughter languages after the breakup of the protolanguage into branches.

Reconstructions may also be called into question based on issues of semantic extension or shift, as well as calquing.[28] A term may reconstruct to a protolanguage, but have signified a different meaning, or only one of multiple meanings, at the time of the protolanguage. Though the term may refer to the intended concept in the daughter languages, this meaning may have been shifted to or appended to the meanings indicated by the term later on. Calquing, or the word by word translation of a term from another language, can also muddle proposed reconstructions. Several related daughter languages have the same calqued term as a result of family-internal borrowing of the calque, and give the appearance of inheritance from the protolanguage. These calques may appear to reconstruct, despite being the result of independent innovations in multiple languages.

Reconstructions can offer insight about which language families may have been familiar with a target concept the longest, and in some cases demonstrate where a concept may have first become salient, or show that the concept predates contact with a particular group. Additionally,

[27] Epps 2015, 580, citing Berlin *et al.* 1973 and Balée and Moore 1991.
[28] Epps 2015, 583, citing Berlin *et al.* 1973 and Balée and Moore 1991.

by combining knowledge of linguistic homelands, language dating methods, and reconstructions, it may be possible to roughly place a date on when and where a concept may have begun, as well as its trajectory. In the case of plants, especially in the Americas, these methods can help differentiate native and post-European contact crops, and identify where certain crops first became relevant for humans. These studies often use reconstructions as their primary linguistic reference points, and combine their findings with data from other disciplines in order to draw meaningful conclusions about the history of the plant being studied.

Balée (2011) considers plantain terms in Tupí-Guaraní languages spoken in eastern South America to argue that, despite some evidence suggesting all bananas and plantains arrived in South America at European contact, at least one species was already present.[29] Balée finds that a common term for plantain is likely to reconstruct back to Proto-Tupí-Guaraní, **pakoß*. Using plantain and banana/plantain-lookalike term data from languages in four of eight Tupí-Guaraní subgroups, Balée reconstructs a series of terms which resemble the Tupinambá plantain term *pakoßa*, suggesting that the term predates European contact in South America. While others have argued that *pakoßa* and terms like it in Tupí-Guaraní languages may actually be a loan from African languages, Balée uses comparative reconstruction to show that it is probable that the Tupí-Guaraní term is descended from Proto-Tupí-Guaraní.[30] Balée additionally shows that the likely directionality of movement of terms between Tupí-Guaraní, Portuguese, and African island São Tomé (a key port between Brazil and Africa during the 15th and 16th centuries) was from Proto-Tupí-Guaraní, into Tupinambá, into Portuguese, and then into São Tomé, likely as the result of plantain export.[31] Balée correlates reconstructions with historical evidence,

[29] Balée 2011, 13.
[30] Balée 2011, 25.
[31] Balée 2011, 29.

including accounts by Europeans who were in 16th century Brazil, dates of European arrival in the various relevant locations to the study, and historical linguistic data to call into question the timeline of initial banana and plantain arrival in South America. By placing the linguistic proposal in context with established historical facts from other disciplines, Balée builds external support for the notion that plantains existed in South America prior to European contact, and that the Tupí-Guaraní term is the donor for loanwords in other languages including Portuguese and languages spoken on São Tomé. There are caveats to the effectiveness of this method, such as the difficulty in reconstructing the meaning of a form alongside the form itself, and the absence of evidence from language families other that Tupi-Guarani, which mean that the argument presented here may not show the reveal the full picture of banana and plantain arrival in South America.[32] Despite these challenges, this study models the process of using multi-disciplinary work to support a theory and better understand a historical timeline.

A series of five papers by Brown *et al.* (2013-2014) utilizes reconstructions of plant terms in the Americas to create maps showing where, and with what approximate time-depth, plant terms reconstruct. Each paper centers on one particular plant, including domesticated squash, domesticated chili pepper, domesticated manioc, maize, and the common bean.[33] The studies collect or propose reconstructions for known major protolanguages of the Americas, or note where the terms in the daughter languages for the subject of the study are not reconstructable. Language families in which insufficient lexical data from the daughter languages was available to determine reconstructability were excluded from the studies. Using a particular chronological approach developed by one of the authors in previous work,[34] each

[32] Epps 2015, 583.
[33] Brown et al. 2013a, 2013b, 2013c, 2014a, 2014b
[34] https://asjp.clld.org/

protolanguage was assigned a (highly tentative) date at which it was last spoken.[35] Each protolanguage was then mapped according to an algorithm which hypothesizes a linguistic homeland. On the maps, the age of the protolanguage is correlated with the size of the circle representing the protolanguage on the map, and protolanguages with reconstructable terms are distinguished from those without. The studies comment on the geographic areas where reconstructions are or are not found, but their central contributions are the maps which visually demonstrate where a plant appears to have been salient for speakers of a protolanguage, and roughly how far before present this salience may have existed. These studies highlight reconstructions, but do not discuss the implications of protolanguages for which a plant term does *not* reconstruct. The studies offer a model for creating an accessible aid to summarize findings from reconstructions. This project will build on this model by additionally examining borrowings of peach palm terms into other languages, as well as discussing the linguistic findings in concert with genetic, historical, and ethnographic evidence for peach palm dispersal around South America.

Analysis of loanwords provides clues about the introduction of concepts to speakers of a language, as well as about when an item or concept may have grown in importance for speakers of a language. When a term in a language can be identified as having come from an unrelated language or language family, *and* no reconstruction for the term's referent has been proposed in the recipient language's protolanguage, the default assumption is that the concept referred by the term was newly introduced to speakers of the recipient language by speakers of the donor language, at the time that the borrowing took place.[36] However, *Wanderwörter* ('wandering words') can disrupt this approach by obscuring the "original" donor of a term, due to the

[35] ASJP has a 29% margin of error (see Brown *et al.* 2013, 5)
[36] Epps 2015, 585; Sapir 1916, 69.

widespread borrowing of the term across languages and language families.[37] Presence of *Wanderwörter* may make it difficult to detect the path of borrowing that a term has taken, when many languages appear to have borrowed a term from various sources.

A second use of loanword examination relates to identifying rising social importance of an item or concept. For example, a loanword may exist in a language whose sister languages indicate that there is a reconstructable form in the protolanguage, but that the language with the loanword replaced the inherited form with a loan. One explanation for this replacement may be a rise in social importance of that referent, for example due to a new use of an item or a cultural event associated with an item or concept.[38] In particular, speakers of the donor language of the loanword may have brought this new context to relevance to speakers of the recipient language, causing speakers to use the term associated with the people who introduced this new importance. Prestige levels of the donor and recipient languages may also motivate such loans, by prompting speakers of a recipient language to switch to a term of higher regional status.

Loanwords can help us trace the histories of interaction among speakers of different languages, and explain what the context of this interaction may have been. By considering linguistic evidence of borrowings in concert with known historical events, archaeological evidence, and work from fields outside of linguistics, loanwords may be used to trace the movements of people and things, and triangulate a relative chronology of movement and contact. In addition, reconstructions can serve as a convenient point of reference for identifying borrowings, and can ground proposed trajectories of movement of objects and concepts by marking points where a particular concept should be present.

[37] Campbell 2013, 434.
[38] Epps 2015, 585.

Nordenskiold (1922) uses linguistic distributions to analyze post-Columbian and partially post-Columbian flora, fauna, and technologies in South America. By looking at terms for a wide range of things, both natural and manufactured, such as scissors, bananas, and horses, Nordenskiold examines how trade networks and contact may have influenced the spread of these things, especially those which are certain to have been brought by European contact.[39] The terms are compared in both a chart and the study's analysis, as well as in a series of maps, which can be analyzed in comparison to one another. Nordenskiold's data allows for comparison of how the distributions of post-European elements pattern together, and where their terms were being borrowed or innovated. The methods used to analyze and map terms is especially relevant, as they identify where loans seem fairly obvious, and where they seem possible, but not certain. Additionally, Nordenskiold's use of historical accounts to hypothesize about motivators for the distributions of terms models how other disciplines can support linguistic findings.

Shepard and Ramirez (2011) take a multidisciplinary approach to the history of the Brazil nut, particularly the human role in its dispersal. Reconstructions serve a starting point for the study, because the presence or absence of a reconstructed term in a particular protolanguage offers an indication of its emergence or spread in a geographic area.[40] Using this finding as a basis, Shepard and Ramirez seek in part to explain how the modern geographic distribution of Brazil nut may have come about. In addition to linguistic evidence, Shepard and Ramirez use field observations and ethnographic evidence to demonstrate "specific cultural practices" that could have motivated Brazil nut dispersal. Shepard and Ramirez also consider other methods by which Brazil nut terms may have come about, especially via analogy to other edible nut names.[41]

[39] Nordenskiold 1922, VIII.
[40] Shepard and Ramirez 2011, 52.
[41] Shepard and Ramirez 2011, 55.

The linguistic evidence itself correlates with genetic and archaeological work which points to a more northern or central Amazonia origin point, and subsequent southern and western dispersal. The summation of these different forms of evidence also suggests that Brazil nut growing was part of a larger sedentary agriculture in Amazonia. Shepard and Ramirez base their arguments not only on their linguistic findings, but also use the combination of previously established research and new investigations to draw new, more detailed conclusions about Brazil nut domestication and dispersal.

Linguistic diversity and typology in Amazonia and South America

Because of its level of linguistic diversity, it is possible to identify histories of contact among speakers of distinct South American indigenous languages. Around 50 language families exist in Amazonia alone.[42] The histories of contact among speakers of these languages are rich, and reflections of that contact have been preserved in the vocabularies of different languages. Many families contain multiple languages and subgroups of more closely related daughter languages. The number of related languages and languages for which no relationship can be demonstrated by current methods offers a large base of data for comparison both within families and among them. In addition, some areas of Amazonia are especially densely populated by speakers of unrelated languages, and have historically been similarly populated. Due to their geographic closeness, their lexicons for flora and fauna are likely to contain similar concepts, which allows for direct comparison of terms to identify borrowings.

Areal linguistics examines the effect of languages in contact on one another, and identifies regions in which related and unrelated languages share several features, possibly as a result of regional diffusion. The existence of a linguistic area, or *Sprachbund*, implies a history

[42] Epps 2009, 581.

of contact among speakers of languages which share features. These languages which share phonetic, morphological, syntactic, or other features may also have lexical borrowing between them. This linguistic contact is often linked to different forms of socially or economically-motivated contact, such as trade networks. Scholars studying areal linguistics in Amazonia, including Krasnoukhova (2012) and Birchall (2014), have recently proposed a division of South America into two areas that exhibit some typological similarities and appear to be relatively different from each other which are relevant to this study: an Eastern South American linguistic area (ESALA) and a Western South American linguistic area (WSALA).[43] ESALA is comprised of "northern and southern Amazonia and the Chaco-Planalto area," and WSALA of "the northern and central Andes, western Amazonia, and the Southern Cone." This division is based typological similarities relating to language structures (such as phonological, morphological, and syntactic features), which appear to be kept within these macro-areas, with significant differences across them. The presence of these regions may suggest histories of other kinds of contact among speakers of languages within these areas. The WSALA-ESALA division also roughly corresponds to the genetic distribution of peach palm types in South America, suggesting a possible correlation of the two major paths of peach palm dispersal with each of these linguistic areas. Linguistic areas offer an additional lens to understand possible motivations for the geography of the modern peach palm distribution. *Figure 2* shows the earlier map *Figure 1* with a line overlaid indicating the rough proposed division of WSALA-ESALA.

[43] Epps and Michael 2017, 953.

Figure 2. Map of peach palm varieties from Clement et al. (2017) with proposed WSALA-ESALA division overlaid

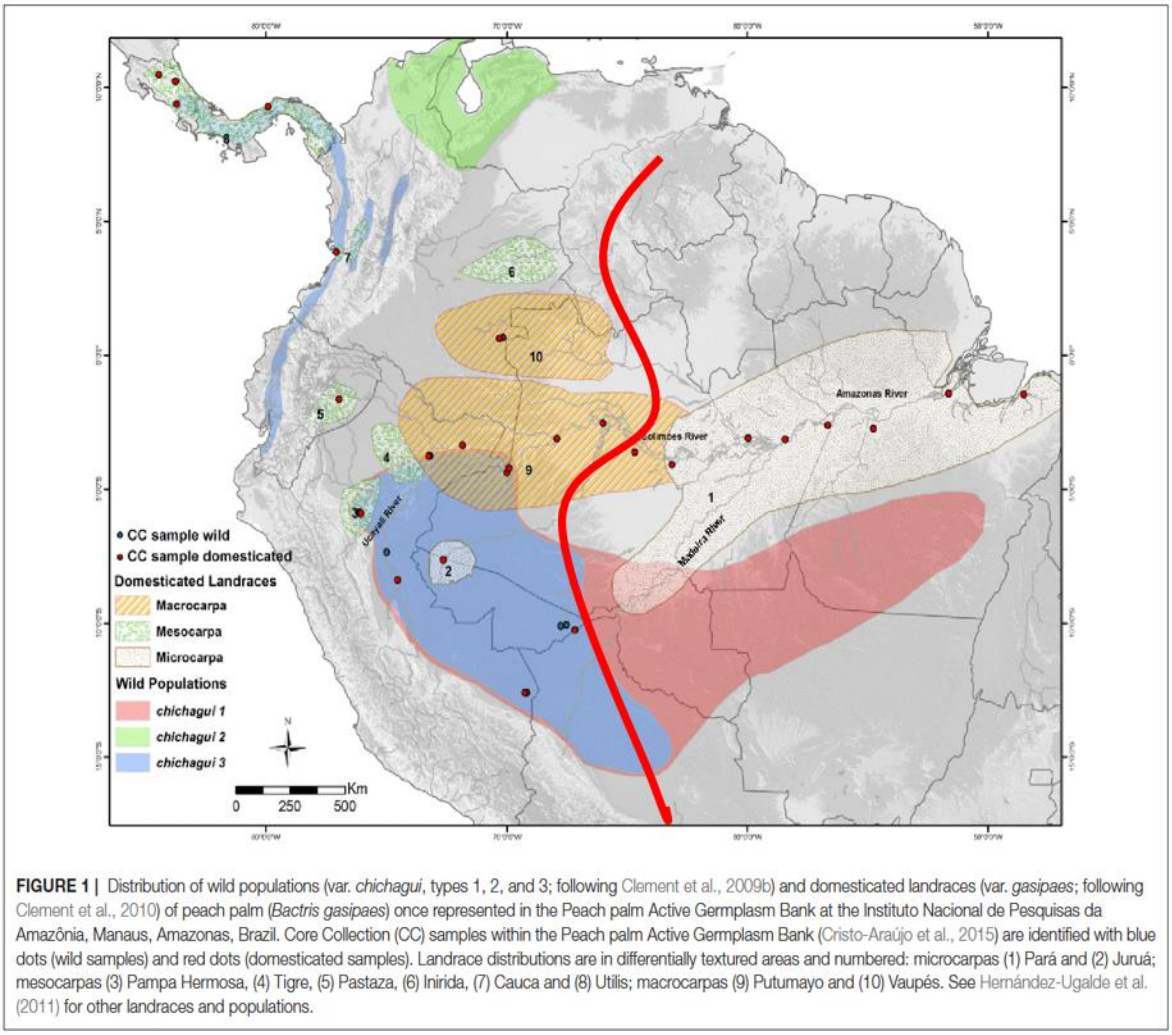


FIGURE 1 | Distribution of wild populations (var. *chichagui*, types 1, 2, and 3; following Clement et al., 2009b) and domesticated landraces (var. *gasipaes*; following Clement et al., 2010) of peach palm (*Bactris gasipaes*) once represented in the Peach palm Active Germplasm Bank at the Instituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, Brazil. Core Collection (CC) samples within the Peach palm Active Germplasm Bank (Cristo-Araújo et al., 2015) are identified with blue dots (wild samples) and red dots (domesticated samples). Landrace distributions are in differentially textured areas and numbered: microcarpas (1) Pará and (2) Juruá; mesocarpas (3) Pampa Hermosa, (4) Tigre, (5) Pastaza, (6) Inirida, (7) Cauca and (8) Utilis; macrocarpas (9) Putumayo and (10) Vaupés. See Hernández-Ugalde et al. (2011) for other landraces and populations.

This project analyzes lexical data from several South American language families, but three of the larger families, Tupí, Arawak, and Carib, are especially relevant due to their wide geographic distributions and presence of peach palm terms in many of their languages. Tupí, which is widespread but concentrated in southwest Amazonia, has been proposed to have seven to ten subgroups, though much of the work on Tupí has been concentrated on the Tupí-Guaraní

subgroup rather than the others.[44] Southwest Amazonia has also been proposed as the linguistic homeland of Proto-Tupí speakers, because of the concentration of Tupí languages from primary branches of the language family still spoken there.[45] The Arawak family is clustered in the west, but is also distributed both north and south of the Amazon river and in the northeast toward the Caribbean.[46] Though proposed subgroupings of Arawakan languages exist, many differ widely in how they group languages. The Arawakan homeland is thought to be somewhere in western Amazonia, likely north of the Amazon river, though the precise area is not fully defined.[47] Several authors have suggested that Arawakan language and culture spread may have been a result of trade and agricultural expansion. Carib languages are spoken in northeast Amazonia, and the family is thought to have eight branches.[48] Northeast Amazonia has also been identified as the linguistic homeland of the Carib family because of the concentration of languages from more distantly related branches spoken in the area.[49] Each of these families has spread outward from their proposed homeland, suggesting that some populations may have migrated over time, or that the languages within these families have spread to new speakers. These movements, combined with the existing numbers of languages within these families, may also suggest some sort of influential social role for speakers of languages in these families.

Widely-distributed language families such as Tupí, Arawak, and Carib can indicate the motivations and paths of dispersal of terms and their concepts, like the peach palm. This project uses both reconstructions in particular families and subgroups as well as presence of loanwords to identify possible contact among speakers of languages, and correlates this contact with other

[44] Epps 2009, 584-5.
[45] Epps 2009, 592.
[46] Epps 2009, 585.
[47] Epps 2009, 592-3.
[48] Glottolog 4.1.
[49] Epps 2009, 592.

types of evidence. The combination of linguistic evidence with work in other fields offers insight into the paths, motivations, and agents of peach palm dispersal.

Conclusion

This chapter has sought to offer key background points necessary to understand the arguments presented in this study. Using the genetic and social profile of the peach palm as established by others detailed in this chapter, this thesis builds on the existing foundation using linguistic, ethnographic, and historical sources to argue that cultural practices associated with the peach palm may have been a major motivator of its dispersal in South America. With an understanding of the effect of European arrival on the crop landscape of Amazonia as well as the arguments made by others about other South American flora, fauna, and technology, this thesis constructs an argument about the dispersal of the peach palm which accounts for evidence from many different disciplines. Finally, linguistic classification and the distributions of typological features relating to language structure in Amazonia inform the arguments of this study by pointing to larger patterns of diffusion in Amazonia not restricted only to language.

3. Historical linguistic perspectives

Introduction and methodology

This chapter centers on linguistic evidence supporting particular trajectories of peach palm dispersal. The contemporary lexicon of a language can point to concepts and things which were salient for present and past speakers of a language and its parent protolanguage(s). By using modern linguistic data, collected from published dictionaries, grammars, and databases as well as communication with linguistic experts, this chapter uses two primary methodologies: comparative reconstruction, and analysis of loanwords. When the results of these two methods are taken together, they can indicate the relationships among speakers of different languages as pertains to peach palm dispersal, as well as suggest a relative chronology of when speakers of different languages may have become familiar with the peach palm.

The dataset for this portion of this project is based on and expands upon work by V.M. Patiño (1960) and Cecil Brown. These existing datasets provided peach palm terms in many South American languages, and served as pointers toward additional sources to locate other terms and other languages in which a term could be sought. These findings were first presented at the 2019 Conference on Indigenous Languages of Latin America in a presentation titled "A linguistic history of the peach-palm (*Bactris gasipaes*) in South America" by Emily Frazier and Dr. Patience Epps. Taking these data as a starting point, terms for peach palm in each language were checked in published dictionaries, grammars, and other works and then recorded with source information in a spreadsheet. The sample of languages was selected to reflect the modern distribution of domesticated peach palm, meaning that the data were focused on Amazonia, with some data from northern South America, Central America, and the Andes. While attempts were made to identify enough terms to sufficiently represent all the large language families of the

region, in some cases, few terms could be identified in the available sources. This does not necessarily indicate that there is no term for peach palm in those languages, as several factors, including a partial or total lack of documentation of the language's lexicon or the unavailability of sources, may have caused gaps in the data. However, in some cases, linguistic and other evidence does suggest that the peach palm is not encountered or used in some regions.

For related languages, a high frequency of cognate terms in these modern languages suggests that in some common past protolanguage, a term for peach palm existed. Where evidence for reconstructions of peach palm terms exists, it can be inferred that the peach palm was present in the lives of speakers of that protolanguage. Loanwords may exist within a language family or across them, and suggest that speakers of one language (or an ancestor protolanguage) borrowed a peach palm term from speakers of another language. In language families where there is more evidence of loanwords than reconstructable terms throughout the languages of the family, it can be inferred that the peach palm may have entered the lives of speakers of those languages relatively later than for speakers of the source language.

Reconstructed forms considered in this chapter come from published comparative datasets which propose reconstructions for common vocabulary terms in related South American languages, communication with linguists who have worked with speakers of languages in that particular family, and tentative proposals by Dr. Patience Epps, University of Texas Department of Linguistics professor. In some cases, reconstructions have been proposed for a proto-form of a peach palm term in the highest known level protolanguage, and suggest that speakers of Proto-Tupian, for example, were familiar with the peach palm. In other cases, reconstructions have been proposed for lower-level branches of a family, such as Proto-Northern Inland Arawakan, which suggests that the peach palm may have been introduced to speakers of languages in that

family after the breakup of the top-level protolanguage. This project will explore the correlations of linguistic evidence with genetic work led by Charles Clement that points to areas with relatively earlier or later domesticated peach palm presence.[50]

Loanwords were identified in the dataset when similar or identical peach palm terms were found in languages not thought to be closely or at all related. Identical forms in unrelated or distantly-related languages were assumed to be loans into at least one of the languages where they were identified, though the exact nature of the loan event was frequently not known. Similar forms appearing in geographically close, but unrelated languages may be good candidates to be loans. In the case of similar, but not identical forms found in geographically distant languages, the known histories of contact and migration among those language groups sheds light on the likelihood that a loan took place.

To determine the directionality of the loan for forms which are good candidates to be loanwords, reconstructions for the language families of the languages in question are a useful tool. In a case where a likely loanword appears in two unrelated languages, for example, if the loanword reconstructs for the language family of one language but not for the other, then it is assumed that the loanword came from the language for whose family the form reconstructs, and was loaned into the recipient language where the form does not reconstruct. In cases where the likely loanword appears not to reconstruct for the family of either language, the directionality of the loan is not clear. Without additional context for the loanword, such as other languages where the form or a similar one appears, the directionality of the loan remains an open question. Where the directionality is clear, however, it demonstrates that speakers of the recipient language most likely came to know the peach palm later than speakers of the donor languages. These findings

[50] See Clement et al. 2017

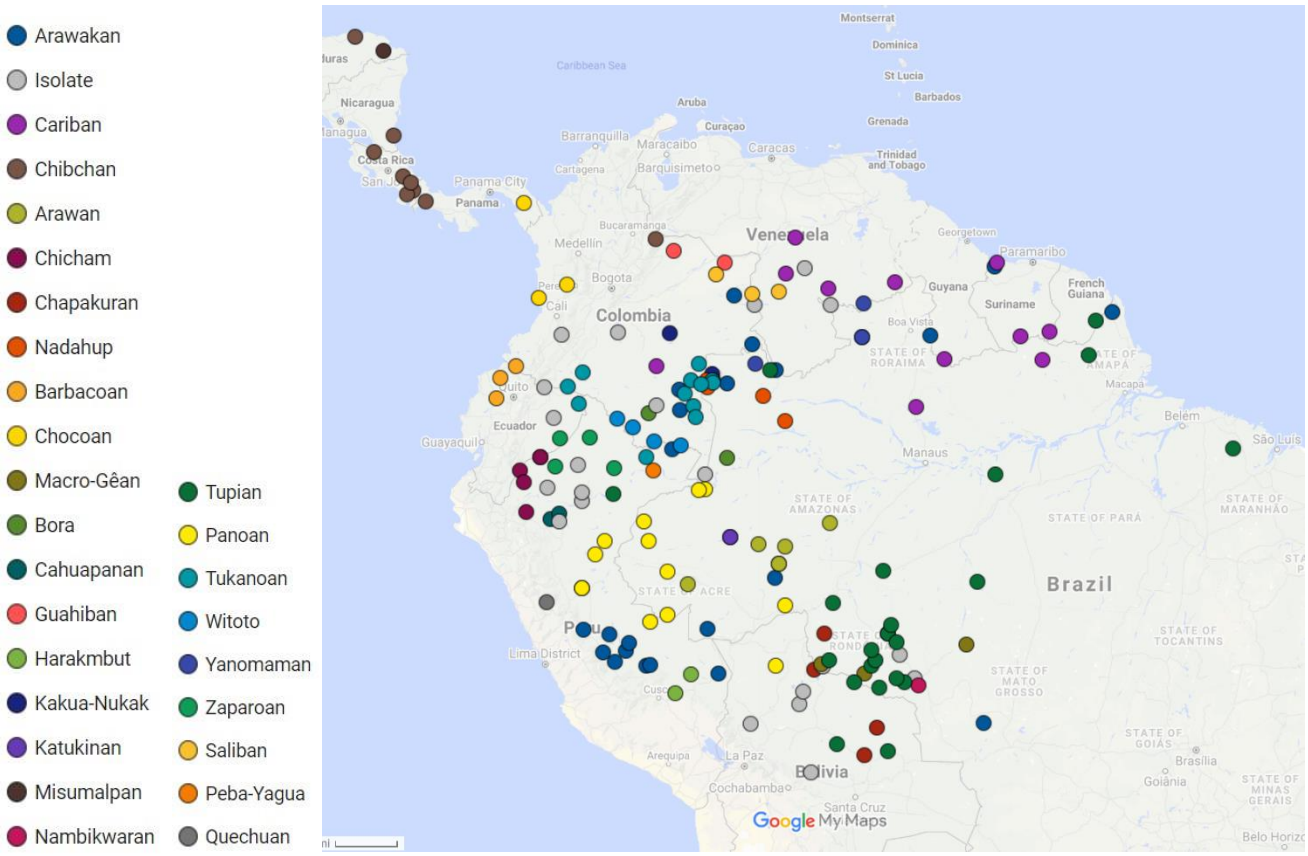
also correlate with genetic work in some cases, such as when the directionality of loanwords appears to follow proposed paths of peach palm dispersal.

Semantic shifts are an additional phenomenon which can be identified from the lexical data used in this project. During data mining from dictionaries and grammars, forms with a different meaning in the same language which were identical or nearly identical to any of that language's peach palm terms were also noted. In some cases, these forms refer specifically to peach palm by-products and are assumed to be derived from the term for peach palm in that language. In cases where the similar form in the language refers to a cultural practice, spiritual being, animal, or a generalized term for a product which can be made from peach palm (like beer), these forms are significant because they suggest that there is a relationship between these other things and concepts and the peach palm. Additionally, cases where the concept or item signified by the other meaning bears similar properties or physical resemblance to the peach palm are especially relevant. The existence of polysemy where peach palm and another item or concept share the same form may suggest a semantic shift occurred in the language, where either the peach palm was named after something already known to speakers of the language, or some other item was named after the peach palm. Contextual information, as well as information about reconstructions and loans may offer insight into the direction of the possible semantic shift. If speakers used the name of something else for the peach palm, it may suggest the peach palm is relatively newer to their lexicon, and if they used the term for peach palm to name another new thing, it may suggest that peach palm is much older for them. The presence of possible semantic shifts in some cases can cast doubt the validity of a reconstructed peach palm term for that language family, because the reconstructed term may not have referred to the peach palm, but rather, an older, different concept or item. However, polysemy may also point to specific links

from the peach palm to certain cultural practices, and may offer insight into how speakers came to be familiar with the peach palm.

Figure 3 is a map of languages for which there is attested peach palm term data used in this project.

Figure 3. Map of all languages with attested peach palm data[51]



Reconstructions

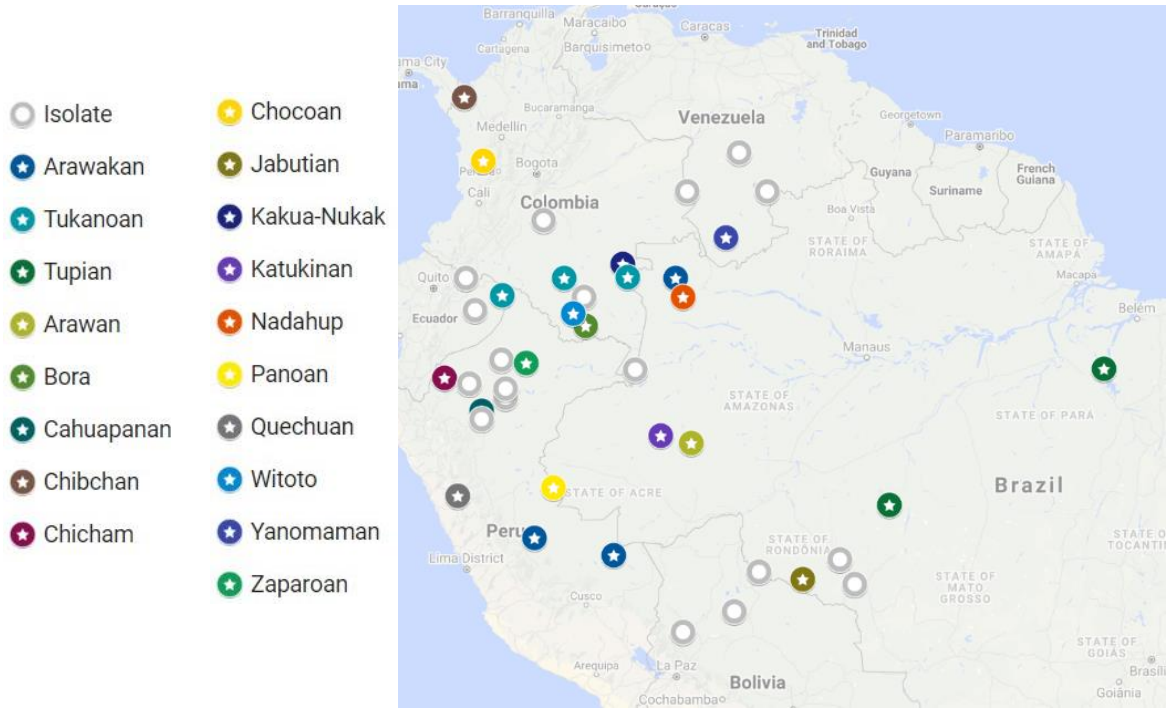
Reconstructions were sourced from published work, identified in consultation with experts on these language families, or tentatively proposed for 18 of the 24 language families for which data were collected for more than one language in the family. Of these, three families are

[51] The coordinate data used in this map comes from Glottolog 4.1. An interactive version of this map and the maps seen in Figures 4 and 5 in this thesis is available here: https://drive.google.com/open?id=1ByrI2H0pIBcOEMDNrJNHGw7SYAn8EqF0&usp=sharing

of particular significance to this project: Arawakan, Tupian, and Cariban. In the cases of Arawakan and Tupian, there are proposed reconstructions for peach palm terms for top or high-level protolanguages within the families. In Cariban, the lack of a reconstructed peach palm term suggests but does not entail that there may not have been a term in proto-Cariban for the peach palm. This would be consistent with the trajectory of genetic diffusion of the peach palm proposed by Clement et al. (2017), and by using both linguistic and non-linguistic evidence, it is possible to build up support for the hypothesis that the peach palm arrived in Carib territory relatively later than in others.

Figure 4 is a map of hypothesized linguistic homelands for protolanguages for which a reconstructed term has been identified and locations where isolate languages for which a term has been identified are spoken.

Figure 4. Map of hypothesized linguistic homelands of protolanguages with reconstructed peach palm terms and locations of isolate languages with peach palm terms[52]



Arawakan

In the Arawakan family, no clear reconstruction for a peach palm term in top-level proto-Arawakan has been proposed, but there are reconstructions for Proto-Northern Inland Arawakan as well as Proto-Southern Arawakan. The Arawakan language family data collected for this project is summarized in *Table 1*.

[52] Locations for reconstructed terms are approximations based on geographic center of distribution of daughter languages and/or proposed linguistic homelands. An interactive version of this map and all others seen in this thesis is available here: https://drive.google.com/open?id=1ByrI2H0pIBcOEMDNrJNHGw7SYAn8EqF0&usp=sharing

Table 1. Summary of data collected for peach palm terms in Arawakan languages[53]

Subgrouping	Language	Principal variant(s)
Northern: Caribbean	Lokono	paripi
Northern: Inland	Piapoco	pipìri
	Baniwa	píipiɻi
	Resígaro	pipí:gí
	Tariana	pípiɾi
	Warekena	pipili
	Yukuna	pipiɾí
	Cabiyari	pípiri
Northern: Negro-Roraima	Wapishana	wazii [?]
Eastern	Palikúr	parip
Central: Paresi-Saraveka-Saluma	Parecís	ða'lajtse
Western	Yanesha'	popoz̧, coroz̧
Southern: Pre-Andine	Asháninka	panataroki, kiriki
	Asheninka	kiri
	Machiguenga	kɨiri
	Nanti	kuri
	Caquinte	kiri
	Nomatsiguenga	kɨ́rí
Southern: Purus	Piro (Yine)	kiru
	Iñapari	awɨ́rɨ
	Apurinã	kawɨ[rɨ]
	Machinere	kõ'nɾeçi

These data support reconstructions for two subgroupings within the Arawakan family, representing two of the larger branches in the family, Northern Inland Arawakan and Southern Arawakan. The subgroupings for Arawakan and all other language families considered in this project follow the current understanding of subgrouping as represented in Glottolog 4.1.[54] These reconstructions are given in *Table 2*.

[53] The full set of lexical data used in this project comes from *Languages of Hunter-Gatherers and their Neighbors* and can be found at the following website: https://huntergatherer.la.utexas.edu/home. The data used in Tables 3, 5, 6, and 7 also can be found on this webpage.
[54] https://glottolog.org/

Table 2. Reconstructions of peach palm terms for Arawakan family branches

Subgrouping	Reconstructed term
Proto-Northern Inland Arawakan ('Japura-Colombia')[55]	*piipi-li
Proto-Southern Arawakan[56]	*kawɨ[rɨ]

Given that these two branches for which terms appear to reconstruct are large, higher level branches within the family, it suggests that the breakup of the Arawakan language family into Northern and Southern branches occurred fairly early relative to the subsequent breakups of the branches into further lower-level branches. Considered in terms of peach palm dispersal, these two reconstructions place peach palm's rise to salience for Arawakan speakers as after the breakup of the Northern and Southern branches, but before subsequent breakups of these protolanguages into lower-level protolanguages or the modern languages.

Within some branches of the Arawakan family for which no reconstructed term has been identified, individual languages have terms which are similar to reconstructed forms in other branches. In Lokono, for example, a Northern Caribbean Arawakan language which is outside the Northern Inland branch, the principal peach palm term identified is /paripi/, which closely resembles terms in several Northern Inland languages. Though the Lokono term appears to metathesize /-pi-/ and /-ri/ as compared to Northern Inland terms, the form is otherwise similar, and could point to the possibility of either a broader reconstruction for a Northern Arawakan branch including Caribbean and Northern Inland Arawakan, or may be explained by an instance of borrowing, either within the Arawakan family or via *Wanderwörter*. Other instances of languages outside reconstructed branches resembling the reconstructed term include /parip/ in Palikúr, which is similar to the Northern Inland reconstruction and the Lokono term. Finally, in

[55] Ramirez 2001, 709.
[56] Epps proposal

Yanesha', the two principal attested forms, /popoz̨/ and /coroz̨/, may resemble the Northern Inland and Southern reconstructions, respectively, though any relationships between these forms are highly tentative.

Tupian

In Tupian, a reconstruction has been proposed for Proto-Tupi-Guarani, which represents the branch of the Tupian family with the most languages, and there are two tentative reconstructions for top-level Proto-Tupi. The Tupian language family data used in this project is summarized in *Table 3*.

Table 3. Summary of data collected for peach palm terms in Tupian languages

Subgrouping	Language	Principal variant(s)
Arikem	Karitiana	ɲõŋ mɨt [bɨt]
Mundurukú	Mundurukú	wesədə̯-ʔá
Ramarama-Puruborá	Karo	jomĩt
	Puruborá	jupikap
Monde	Gavião	jobat
	Zoró	jobat
	Suruí	jobára(a)
	Aruá	jobat
Tupari	Akuntsu	kɨʔa
	Mekéns	taapiɾo
	Wayoro	tɨt
	Tupari	sɨt
	Makuráp	tɨ(ɨ)t
Maweti-Guarani	Mawé	mɨɾawe
Tupi-Guarani	Urubu-Ka'apor	pupũj
	Nheengatú	pupuya
	Kokama-Kokomilla	pɨpɨtʃɨ
	Emerillon (Teko)	palepɨ
	Wayampi	pɨpɨi
	Tupinambá	sere-[ɪβa][57]
	Guarani Antigo	(t)sɨ́ɾɨ[58]
	Parintintin (Kagwahib)	hɨɾɨʔ-ßa
	Siriono	siriba
	Pauserna (Guarasugwe)	híri
	Guarayu	sɨɾɨ

[57] 'mangue-siriúba (Avicennia spp.), boa madeira'
[58] Ruiz de Montoya (1639: 115v): ‘palm for arrow points’

These data support a reconstruction of a peach palm term for the Tupi-Guarani branch, and two tentative reconstruction possibilities for the Tupian family as a whole, which are given in *Table 4*.

Table 4. Reconstructions of peach palm terms for Tupian family branches

Subgrouping	Reconstructed term
Proto-Tupi-Guarani[59]	*tsiri
Proto-Tupian[60]	*tɨt(ɨ) OR *mɨt

Though Ramirez and França propose a reconstruction for Proto-Tupi-Guarani based on cognate forms in some Tupi-Guarani languages,[61] including Tupinambá and Guarani Antigo, which are no longer spoken, modern Southern Guarani languages do not have a term for the peach palm, nor does it grow in that region.[62] Tupinambá and Guarani Antigo were spoken in the region where Southern Tupi-Guarani languages are spoken today. However, within the Tupi-Guarani branch, several apparent Arawak loans also appear, such as /pɨpɨi/ in Wayampi. Based on forms in the Tupari branch which appear cognate with those of the Tupi-Guarani branch, Epps tentatively proposes *tɨt(ɨ) as a possible peach palm term for Proto-Tupi. Based on other cognate forms in other branches of Tupi, including Maweti-Guarani, Epps also tentatively proposes *mɨt.[63] Because both reconstructions rest on cognate forms in both Maweti-Guarani (of which Tupi-Guarani is a branch) as well as other Tupian branches, both may be reconstructed for Proto-Tupian rather than a single branch.

[59] Ramirez & França 2017.
[60] Epps proposal
[61] Ramirez & França 2017.
[62] Clement, Rival, & Cole 2009, 134.
[63] Frazier & Epps, 2019.

Cariban

In Cariban, there is no evidence among the data used in this project that a reconstruction for peach palm is possible. The data for Cariban are assembled in *Table 5*.

Table 5. Summary of data collected for peach palm terms in Cariban languages

Subgrouping	Language	Principal variant(s)
Apalaí	Apalaí	epare
Guianan	Kariña	amana
	Maquiritari (Yekuana)	hihiːri
	Carijona	hareho
	Trió	pupunja
	Wayana	palepɨ
Parukutoan	Waiwai	aparpu
Venezuelan	Panare	atʃama
	Pemon	təpəːɾi
	Yawarana	pɨpɨri
Yawaperi	Waimiri-Atroari	merepɨ

Several Cariban languages have peach palm terms which resemble those of the Arawakan data (%pipiri). However, the patterns of sound correspondences within Cariban languages indicate that these forms are not cognate, but rather are the result of borrowings of peach palm terms from other languages. In addition to Arawakan, some of these %pipiri forms likely came into Cariban through Tupi-Guarani (where the form likely came from Arawakan), such as the Wayana term /palepɨ/, which is identical to the Emerillon term in Tupi-Guarani. Other Cariban languages with %pipiri forms which may have come to them through Tupi-Guarani include Waimiri-Atroari, Carijona, Waiwai, and Apalai. Some of the sound changes which would have had to occur for two forms to be linked, like /p/ in the donor language to /h/ in Cariban, are attested.

The apparent high number of peach palm loanwords in Cariban and lack of reconstruction suggests that the peach palm arrived in Cariban territory relatively later than it arrived in Arawakan territory, for example, and that Arawakan speakers may have been

spreading peach palm terms into Cariban territory. Since some Cariban terms appear to come from Tupi-Guarani as well, some of the spread may be attributed to speakers of other languages. However, the directionality of borrowing in many cases is highly tentative or entirely unknown, and so some Tupi-Guarani terms may come from Cariban, rather than vice versa.

The presence of reconstructions, even tentative ones, for high or top-level branches of the Arawakan and Tupian families suggest that peach palm has long been known to speakers of these languages. In addition, the presence of loanwords from both Arawakan and Tupian and lack of a reconstructed term in Cariban languages suggests that Arawakan and Tupian speakers may have contributed to the spread of peach palm in northeast Amazonia, and that this spread was relatively later than peach palm spread in southern and northwestern Amazonia. The pattern of peach palm spread suggested by these reconstructions roughly corresponds to the dispersal of peach palm proposed by Clement et al. (2017) based on genetic evidence, as Clement proposes that one dispersal event began in southern Amazonia, in contemporary northern Bolivia, and spread to the northwest through Peru, western Brazil, and Colombia.

The next section will take a more fine-grained look at loanwords, including proposals for specific donor and recipient languages of certain forms.

Loanwords

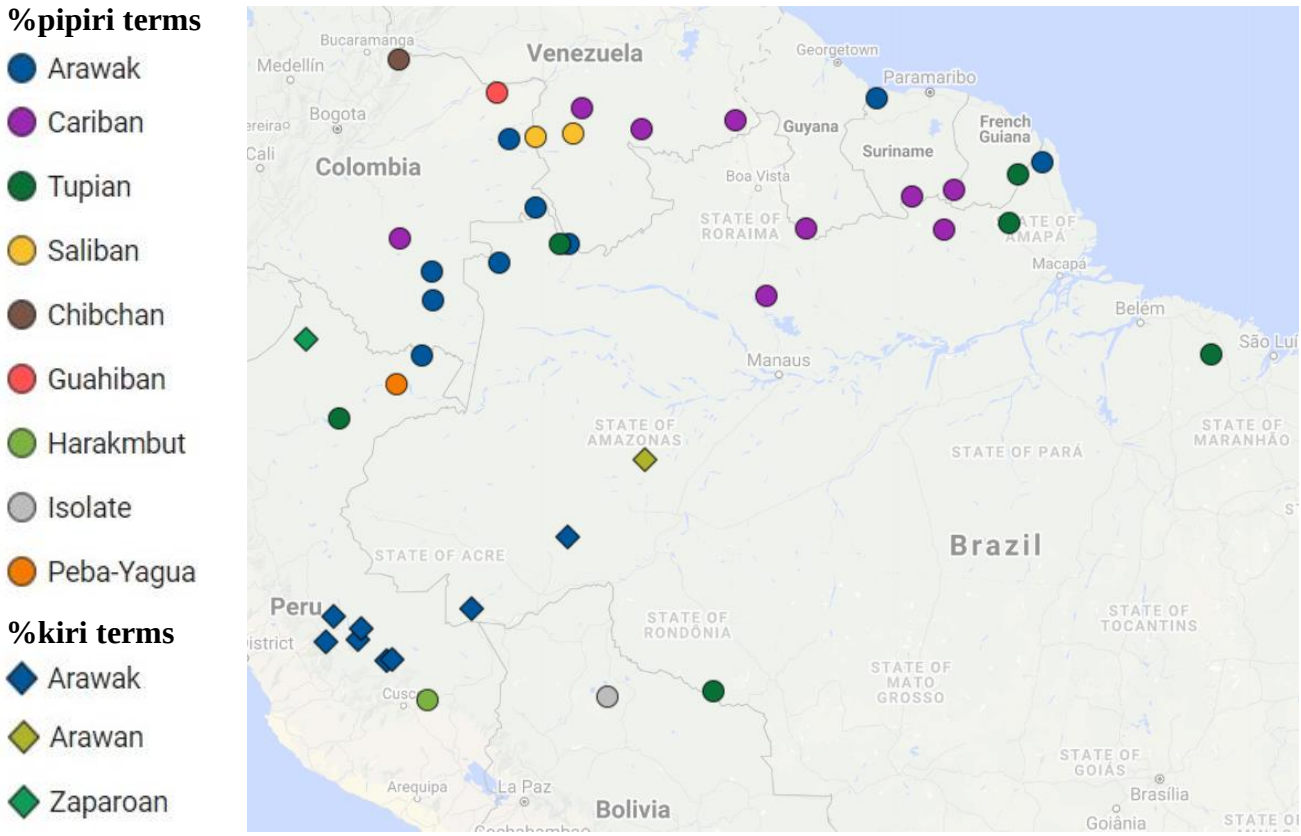
The primary peach palm form which appears to have been borrowed into several languages is form like %pipiri, which reconstructs in Northern Arawakan, but not any other language family. In addition, another form, %kiri, which reconstructs in Southern Arawakan appears to have been borrowed into some languages outside the Arawakan family. An overview of language families with possible %pipiri and %kiri loans is given in *Table 6*.

Table 6. Summary of families with %pipiri and %kiri forms

Language family	# of languages with %pipiri forms	# of languages with %kiri forms
Cariban	10	0
Guahiban	1	0
Harakmbut	1	0
Cayuvava (isolate)	1	0
Peba-Yagua	1	0
Saliban	2	0
Tupian	6	0
Arawan	0	1
Zaparoan	0	1

Figure 5 is a map of %pipiri and %kiri terms in Arawakan and possible loanwords.

Figure 5. Map of %pipiri and %kiri Arawakan terms and possible loanwords[64]



[64] The coordinate data used in this map comes from Glottolog 4.1. An interactive version of this map and all others seen in this thesis is available here: https://drive.google.com/open?id=1ByrI2H0pIBcOEMDNrJNHGw7SYAn8EqF0&usp=sharing

Because the only reconstruction of a %pipiri form comes from Northern Arawakan, these forms indicate a spread of %pipiri forms from west to east. However, as indicated earlier, several Cariban %pipiri forms appear not to have entered Cariban languages directly from Arawakan, but rather through Tupi-Guarani, where the forms may have originally entered from Arawakan. Some of these %pipiri forms which entered Cariban languages through Tupi-Guarani may have spread back in the western direction from the east, suggesting that not all loans were occurring in the west to east direction, and that not all peach palm dispersal was happening exclusively in that direction either. Though the distribution of peach palm terms in Arawakan, Cariban, and Tupian indicates that there has been borrowing among languages in the three language families in the northeast corner of Amazonia, in many cases it is difficult to propose the path that a loanword has taken through different languages.

In several cases, the Tupian languages with %pipiri forms appear to have been loaned directly from Arawakan, based on the similarity of the forms and geographic proximity of where the languages are spoken today. However, it is not clear in every case that the loan came directly from Arawakan when other nearby languages in other families also have %pipiri forms. In addition, in most cases it is difficult to propose a specific donor language for a form, even when the family can be identified, because many languages are clustered together in a relatively small geographic area. In particular, several Arawakan, Cariban, and other single languages with %pipiri forms are in such close geographic distribution that the data do not suggest any particular direction or path of most of the loaned terms, other than that they likely originally came from Arawakan.

The %kiri forms, for which a tentative reconstruction has been proposed for Proto-Southern Arawakan, only appear otherwise in two languages: Paumarí, an Arawan language, and

Arabela, a Zaparoan language, which is spoken a somewhat further distance from the other languages with %kiri forms. These forms appear to have been loaned from Southern Arawakan languages, though it is not clear from which.

The patterns of borrowing of both %pipiri and %kiri forms demonstrate a general northeast movement of peach palm terms, which is consistent with the paths of peach palm dispersal proposed by Clement et al. using genetic analyses. If the peach palm was domesticated in southwestern Amazonia and subsequently dispersed by human interaction, like trade networks, this model of northeastern spread of peach palm terms supports that hypothesis. In addition, this spread of primarily Arawakan-sourced terms is consistent with the known significant role of Arawakan speakers in trade and interaction among speakers of different languages in Amazonia.

Polysemy and semantic shifts

In some languages, the same term may refer to something else other than peach palm (polysemy), or may refer to something else when an affix is added or removed. Cases of polysemy and similar terms with different meanings may suggest that semantic extensions have taken place, in which either a term referring to something else is used for the peach palm, or where a peach palm term is used to refer to another referent. In most cases in these data, it is not determined which way the semantic shift may have occurred, or even certain that there is a relationship between the two terms beyond chance. However, other cases may give insight into broader patterns which pertain to motivations for peach palm spread. The instances of polysemy or similar terms with an additional affix are summarized in *Table 7*.

Table 7. Summary of instances of polysemy and near-identical terms in peach palm data

Family	Language	Peach palm term	Similar term	Meaning of similar term
Arawan	Jarawara	jawita	jawita	‘tanager’
-- (isolate)	Cofan	o'ma	oma'ndo	‘macaw’
Tupian	Parintintin	hɨɾɨʔ-ßa	hyryva	big green bird with long beak
Bora	Bora	meéme	mééméuwa	‘species of red butterfly’
Cariban	Kariña	amana	amana	‘Amana river’; related spirit
Yanomaman	Yanomami	raʃa	rashapɨ	spine (of animals)
Arawan	Paumarí	kawiri	kawi	'alcoholic drink, caxiri'[65]

While these instances of polysemy and near-polysemy may be chance occurrences, several of the additional meanings refer to things similar in color to the peach palm’s fruit, include ‘tanager’ in Jarawara, ‘macaw’ in Cofan, and ‘species of red butterfly’ in Bora. It is possible that either the peach palm was named in these languages for the other referent, or that the other referent was named for the peach palm. However, both the macaw and the tanager are native to South America, meaning that there is no clear reason to conclude that the semantic extension went one way or another, as neither were brought to South America at European contact, for example. In the case of Bora, it is likely that the butterfly term was created based on the peach palm term, given that the butterfly it describes is red, like some peach palm fruit, and that the butterfly term has a suffix that the peach palm term lacks. Additionally, in Jarawara, the term for peach palm is cognate with others in the Arawan family, and the term reconstructs for proto-Arawan as *jawida, but materials on other Arawan languages are not substantial enough to identify if the peach palm/tanager polysemy is present in languages other than Jarawara.

In Kariña, the term for peach palm (/amana/) also refers to the Amana river, and a related spirit. This form is similar to an Arawakan term meaning ‘dolphin’, which is a known *Wanderwort* which has been loaned to other languages in the area. The term in Kariña may be

[65] *caxiri* is a type of manioc/cassava beer

another instance of the Arawakan *Wanderwort*, which came to refer to peach palm, perhaps due to a relationship with the spirit meaning. This may suggest another way in which Arawakan speakers played a role in the dispersal of peach palm.

In Yanomami, the term for peach palm closely resembles a term for a spine on an animal. The term for spine, /rashapɨ/, has an additional affix. These terms may be related because peach palm trees have spines. There is not evidence to suggest the semantic extension went one way or the other, but it is plausible that there is a connection between the two terms due to their similar properties.

In Paumarí (Arawan), the term for peach palm is similar to a term for an alcoholic drink (‘kawi’). The Paumarí term, /kawiri/, is likely a loan from Southern Arawakan languages. The relationship between these terms is likely not coincidental, because fermented, alcoholic beverages are commonly made from peach palm fruit. It is possible that the term for an alcoholic drink was based on the term for peach palm, because peach palm fruit was a common source for making alcoholic beverages. Related to this relationship, the reconstructed peach palm term *kawɨ[rɨ] in Proto-Southern Arawakan, which is the protolanguage for the likely donor language of the Paumarí form, has the suffix *-rɨ, which is likely a grammatical element, like a classifier. Without this grammatical element, the proposed root reconstructed term is *kawɨ. This form is likely a loan into Proto-Southern Arawakan from Proto-Tupi-Guarani meaning ‘fermented drink,’[66] suggesting an even stronger relationship between the peach palm and alcoholic drinks.[67] The existence of a term for an alcoholic beverage which is related to peach palm suggests that alcoholic beverages may have been one motivation for groups spreading the peach palm to other groups in South America, and that Proto-Tupi-Guarani speakers may have introduced the peach

[66] Mello 2000, 171.
[67] Many thanks to Zach O’Hagan for bring this relationship to the author and Dr. Patience Epps’ attention

palm to Proto-Southern Arawakan speakers in a region near where the peach palm was first domesticated. Given the proximity of the hypothesized Proto-Southern Arawakan and Proto-Tupian homelands to the peach palm domestication locus in northern Bolivia, contact between speakers of some Proto-Tupian language and Proto-Southern Arawakan speakers may have begun some early peach palm dispersal.[68]

Conclusions

The reconstructed peach palm terms within the Arawakan and Tupian families, combined with the relatively wide geographic distributions of those families and the apparent presence of loanwords from those languages in other families suggest that the peach palm may have been familiar to speakers of Arawakan and Tupian languages for the longest period of time in relations to the set of language families considered here. The lack of a reconstructable term in the Cariban family, whose languages are spoken in an area where peach palm grows today, combined with the number of terms seemingly loaned from Arawakan and Tupian, suggest that the peach palm arrived in that region of Arawakan later than other areas, possibly introduced by Arawakan and Tupian speakers. This proposal is consistent with the genetic picture painted by Clement et al. (2017) of peach palm dispersal. The broad presence of Arawakan loanwords into individual languages also suggests that Arawakan speakers, in particular, may have played a large role in spreading the peach palm around South America, especially from western to eastern Amazonia. Finally, cases of polysemy of peach palm and other referents suggest that peach palm may have been named after referents already in the lexicon of speakers of a particular language, or vice versa. The case of the Paumarí term for ‘alcoholic drink’ is significant, as it suggests a particular association between the peach palm and fermentation for making alcoholic drinks.

[68] See *Figure 4* for rough locations of hypothesized homelands.

Even more notable is the likely relationship between the Proto-Tupi-Guarani term for ‘fermented drink’ and Proto-Southern Arawak peach palm term as it suggests that alcoholic drinks may have been a primary means by which the peach palm was spread and introduced to new people. As will be discussed in the next chapter, fermented, alcoholic peach palm drinks play a large role in the ritual and ceremonial culture of many indigenous groups in western Amazonia, and several share similar traditions which suggest a motivation for peach palm spread in that region.

4. Patterns of cultural and social use in ethnographies

Introduction and methodology

Ethnographic and historical records of indigenous peoples' cultural practices offer another lens which can be used to understand the role of the peach palm in the histories of movement and contact among speakers of indigenous South American languages. In this chapter, I examine parts of the ethnographic record for indigenous communities located in areas where the peach palm grows. I analyze the patterns of social and cultural uses of peach palm and compare this distribution with that of peach palm terms and genetic evidence of peach palm varieties.

Ceremonial uses of the peach palm, especially those associated with beer-making, may point to one motivating factor for peach palm spread around South America. Similar rituals and traditions relating to peach palm fruit and the peach palm fruiting season found in numerous communities could indicate that the peach palm was initially shared as part of a diffusion of cultural practices from one community to another. These patterns may also offer insight about how important the peach palm has been to different groups, and what sorts of uses might have been involved in its diffusion. In addition, the absence of documented ceremonial and cultural uses of the peach palm in a specific geographic area may support the hypothesis that the two major paths of domesticated peach palm dispersal were motivated by different factors. This evidence may also correlate with the genetic evidence presented by Clement et al. (2017) indicating that selection and use of starchy peach palm fruit for fermentation may have driven the development of the larger fruit size found in western Amazonia.

Ethnographies were initially selected based on a search for anthropological works about South American indigenous groups which referenced the peach palm at all. The number of

sources was expanded based on the distribution of this project's linguistic data on peach palm terms, with the intent to select a wide geographic distribution of work. In addition, if any sources made reference to similar traditions or uses in other groups, ethnographies were specifically sought out for those groups. While the sample of ethnographies examined is not representative of all indigenous groups, and therefore may obscure some patterns of social or cultural peach palm uses, it is intended to give a rough idea of the distribution of ceremonial uses, like beer-making, among indigenous groups in South America.

Fermentation and festivals

Several indigenous groups make a fermented drink or other beverage out of peach palm fruit, especially in northwest Amazonia. Some groups drink a peach palm beer year-round, while others associate the fermentation and consumption of a peach palm beverage with a festival which marks the start of the peach palm fruiting season. The Makuna, a Tucanoan language-speaking group, celebrate the peach palm ripening with song and dance, and drink a fermented peach palm drink during a specialized mask dance known regionally as the dance of the dolls.[69] Other Tucanoan and nearby non-Tucanoan groups share a similar dance sequence.[70] The Yukuna people, an Arawakan language-speaking group, also mark the peach palm ripening with a festival and associated beer-making.[71] The creation and consumption of a fermented peach palm drink appears outside the festival context as well, such as in the Southern Arawakan Asháninka peach palm origin story, which says that a person who was turned into a peach palm instructed another man to make a fermented drink from the peach palm and mix it with another fermented drink made of cassava.[72] In each case, the peach palm is celebrated or is symbolically important,

[69] Århem 2004, 154.
[70] Oyuela-Caycedo 2004, 56.
[71] Oyuela-Caycedo 2004, 56.
[72] Sosnowska and Kujawska 2014, 187.

and an element of the celebration event is the creation and consumption of a fermented peach palm drink.

While some festivals involving the peach palm uniquely revolve around the peach palm's ripening season, other groups hold festivals which can use any fruit available in large quantities, of which the peach palm may be one. Some groups in the area drained by the Pirá-paraná river in the Vaupés region of Colombia hold a communal dance which requires large amounts of "wild or cultivated tree-fruit," and for the Barasana, this ritual, called Fruit House, which is based on a more involved ritual called *He* House, should mark the ripening of "important" fruits.[73] Also according to the Barasana, *He* House should be held during the ripe season for the peach palm, which is February to March, in addition to ripe seasons for other fruits.[74] Fruit House precedes *He* House in these situations, and serves as preparation for *He* House. Though the peach palm is not *uniquely* central to these ceremonies in general, for the Barasana, it is one of multiple fruits whose ripe seasons correspond to a specific ritual.

Symbolic associations

The peach palm's ripe season can also mark the passage of time or an ideal time for certain events. For the Huaorani in northwestern Amazonia, the standard method to count years is by the passage of peach palm ripening seasons, which last from January to April.[75] Peach palm consumption can come in the form of drinking ceremonies and marriage celebrations for the Huaorani, and so these events tend to fall during the time that the peach palm is ripe and most abundant.[76] For the Napo Runa in Amazonian Ecuador, it is preferable to hold weddings during the peach palm's ripe season from December to March, in part because acquiring the large

[73] Hugh-Jones 1979, 41.
[74] Hugh-Jones 1979, 66.
[75] Rival 2002, 47, 194 (footnote 1).
[76] Rival 2002, 85.

quantities of food needed for weddings can be easier during this season.[77] The drier weather can lower river levels and allow for easier fishing, and animals feed on the peach palm fruit on the ground, which simplifies hunting. In addition, the fruit is consumed in a special beverage for weddings. This symbolic association of the peach palm with time suggests that its presence has been central to the ceremonial calendar of these groups for some time.

Other symbolic associations with the peach palm include notions of fertility and inter-generational connection. The Huaorani associate human fertility with the peach palm fruiting season, and Rival (2002) also notes that nearby groups, such as the Shuar and the Yagua, also share some association of the peach palm with fertility[78]. Rival additionally argues that the horticulturalists, trekkers and foragers of northwest Amazonia share similar notions of "fertility, abundance, and continuity" with peach palm groves.[79] The *Makuna* mask dance, which marks the peach palm ripening, also serves to lengthen peoples' lives and protect children from illness.[80] The dance associated with the ceremony fertilizes plants, animals, and people.

The Nukak associate the physical spaces of peach palm orchards with relationships between ancestors and their current descendants, particularly because when people die, the plants they planted are cut down, with the exception of peach palm and achiote.[81] The orchards in which peach palm and achiote grow have special significance, because they contain trees planted by people who have since died. In these orchards, the Nukak also hold ritual meetings as well as funeral wakes and burials during the peach palm ripening in February and March, underscoring their significance as locations with a connection to ancestors and the dead.[82] Though each of

[77] Uzendoski 2005, 78.
[78] Rival 2002, 85-6.
[79] Rival 2002, 88.
[80] Århem 2004, 155.
[81] Politis 2007, 288-9.
[82] Politis 2011, in *The Prehistory of Food,* Chris Gosden & Jon Hather, eds., 103, 117. Politis 2007, 280.

these symbolic associations with the peach palm is unique, each one highlights a particular role for either the fruit or act of cultivating the peach palm in the way these groups view the passage of life.

Origin narratives

Several authors have recorded origin stories told by people in different indigenous communities which explain how the peach palm came to enter their world. The Nukak say that the first Nukak who emerged from the "underworld" carried peach palm with them in bags.[83] This suggests that in Nukak history, the peach palm has been and continues to be an important cultural element.

Three indigenous groups in western Amazonia, in modern-day Peru near the Andes, share similar peach palm origin narratives. The Asháninka and the Yanesha' all have variations of a story in which a child whose parent has the power to change humans into animals and/or inanimate objects has the same power and is ultimately transformed himself into a peach palm tree. The Nomatsiguenga also have a variation of this narrative, and while the characters are similar, it is not clear if the peach palm is involved.[84]

In the Asháninka version, the child-turned-peach-palm-tree instructs another man who finds him in the peach palm state to cook and ferment the fruit and make beer from it.[85] In addition, the man who was instructed to ferment the peach palm climbs the peach palm tree to collect fruit, and eventually bends "toward the south" to find more fruit on the tree, and takes a lot of fruit from there. In the story, this explains why one does not find much peach palm fruit to

[83] Politis 2007, 280.
[84] Shaver & Dodds 1990, 92-93.
[85] Sosnowska & Kujawska 2014, 183-187.

the south of where Asháninka is spoken in contemporary Peru, and why it is smaller than what is found in other areas.

Gaps in documentation and identification of ceremonial traditions

Ethnographies were sought out to create a sample which was geographically and linguistically representative of all attested peach palm data used in the linguistic chapter of this project. However, not all geographic areas and language families have had the same amount of linguistic and ethnographic documentation, and in general, less documentation work has been done in eastern Amazonia. In identifying ethnographies with discussion of the peach palm, all examples came from western Amazonia. When research was narrowed to look only for sources written about groups in eastern Amazonia, the sources found only made reference to the peach palm as a food source, or only named it and gave no additional information. For example, in materials about plant use by Urubú-Kapoor (Tupian) speakers, the peach palm is familiar but "in the initial stages of cultivation" for some people, and there is no additional discussion, about peach palm use, indicating a likely relative lack of social importance.[86] Due to the scope constraints of this project, it was not possible to methodically search for ethnographies of every or even most groups whose languages have documented terms for peach palm. As a result, the lack of representation for eastern Amazonia should not be taken necessarily as a reflection of the frequency of cultural traditions associated with the peach palm.

The fruit of the type of peach palm dispersed in the eastern direction of dispersal is smaller and contains more oil than the type dispersed in the west, and the starchier makeup of the western variety is what allows it to ferment well.[87] If the type of peach palm which grows in communities in eastern Amazonia cannot be fermented to make an alcoholic drink, or is more

[86] Balée 1994, 274.
[87] Clement et al. 2017, 14-15.

difficult to ferment than other plants, cultural traditions related to fermentation are unlikely to spread or be popular in that area.

Conclusions

The ethnographies discussed in this section indicate that for many language groups, primarily in western Amazonia, alcoholic peach palm drinks are a central element of ceremonies and festivals which mark the peach palm fruiting season. The fruiting season and physical space in which the peach palm grows is also associated with marriage, generations, and fertility in some groups. Several groups tell origin narratives specifically for the peach palm, and in at least three Arawakan language groups, the narratives are highly similar, though the characters have different names in each. The three Arawakan groups with similar origin narratives are in close geographic proximity, suggesting that the narrative was diffused to all three groups at some point during their shared history, or that the languages of the three groups form a shallow subgroup and have maintained this narrative since they diverged. The ethnographies discussed in this chapter are only a sample of the cultural traditions of different groups, but they indicate the role that the peach palm plays in ritual and ceremonial culture for different communities, especially in western Amazonia, where the peach palm fruit are well-suited for fermentation. The evidence presented in this chapter supports the argument that cultural traditions has been and continues to be central to peach palm use in South America, and that there may be a split in peach palm usage and spread along the two paths of peach palm dispersal proposed by Clement et al. (2017). The fairly wide distribution of groups in western and northwestern Amazonia with cultural traditions relating to the peach palm and peach palm fruit fermentation builds support for the argument that alcoholic drink-making may have been one major motivator for peach palm dispersal in the past. Considered with the lexical evidence in chapter three, which demonstrates how peach palm terms

have spread and been borrowed, these widespread similar uses of peach palm suggest that uses like these were a key element of introducing the peach palm to new people and regions in South America.

5. Contemporary use and lack of global significance

Introduction and methodology

The peach palm remains a ubiquitous and important crop among indigenous groups in South America, and its fruit can be found for sale in rural and urban areas. However, unlike other New World crops, such as potatoes and manioc, peach palm fruit has never found a place in the global market of crops native to South America. Instead, the fruit (though not the palm hearts) remain relatively unknown outside of Latin America, despite being very well-known and culturally significant to many communities in Amazonia. The peach palm is by no means the only crop important for indigenous groups but relatively unknown to the rest of the world, but it shares nutritional and other properties with other New World crops which have become significant in global crop production.

In this chapter, this project turns toward the peach palm's contemporary situation as a locally important but globally unknown plant. First, this chapter will discuss the peach palm's economic circumstances in its local market, as well as efforts which have been made to export the fruit and other parts of the tree. It will also investigate the peach palm as compared to other well-known New World crops which have become staple foods around the world. Additionally, it will draw on scholarship using primary sources from European contact and colonization in Latin America to examine early European interactions with the peach palm. Ultimately, it is not within the scope of this project to examine all possible causes of the peach palm's relatively unknown status around the world. However, by identifying modern efforts which have been made to develop it for commercial use, comparing it to other New World crops with different trajectories, and considering the European colonial relationship to it, it is possible to understand

where the peach palm's course went differently from that of crops which have become globally known and used.

This chapter will investigate the peach palm's lack of global importance using concepts and terms borrowed from Robert Proctor and Londa Schiebinger's edited volume *Agnotology: The making & unmaking of ignorance*. Agnotology is the study of culturally-induced ignorance, particularly that of which we are still ignorant, of which we are selectively ignorant as a result of paying attention to something else, and of which we are ignorant as a result of concerted efforts to prevent knowledge production on that topic.[88] In the case of the peach palm, the 'ignorance' of the peach palm is primarily on the part of non-Amazonians, and this chapter will examine possible explanations for this ignorance. This chapter will consider the peach palm in the context of these three forms of agnotology, and ultimately argue that the global ignorance of the peach palm is the result of "lost realm" ignorance, in which the peach palm was ignored rather than investigated, used, and commercialized because other crops were selected and valued instead.[89]

Economic history

In addition to peach palm's uses by communities which grow it, and the associated cultural traditions, the fruit are also sold in cities and towns, especially by street vendors. These fruits are usually boiled, and sold as a snack food or appetizer.[90] Additionally, in several countries, including Brazil, Colombia, Costa Rica, and Peru, is it common to find whole, uncooked peach palm fruits for sale in local markets. However, in some areas, only about 40-50% of fruits produced by farmers is sold to consumers as whole fruits, due to consumer demand and preferences for particular colors, sizes, and oil vs. starch contents.[91] The unsold portion of

[88] Proctor 2008, 3.
[89] Proctor 2008, 3.
[90] Smith 2015, 185.
[91] Clement et al. 2004, 199-201.

the fruit yield can be used to feed farm animals, though fruits are not generally marketed or prepared for this purpose.[92]

In Costa Rica, processed peach palm fruits produced on a larger scale than daily-prepared fruits were once introduced into the market there. These processed and jarred fruits could be preserved for a longer period of time than fresh fruits, which spoil relatively quickly. However, peach palm now grows all over Costa Rica, meaning that fruit is available year-round, rather than only during one region's fruiting season.[93] Fresh fruits are preferred by consumers and cheaper than the jarred product, and so the processed and preserved fruits have fallen out of favor in Costa Rica.[94] In both Costa Rica and Peru, the peach palm has been the object of concerted marketing efforts through fairs and festivals. However, the peach palm's seasonally-limited availability in Peru combined with the lack of readily-available by-products such as flour in both Costa Rica and Peru has caused these events not to cause a particular uptick in demand or commercial production efforts.[95] These efforts to market uses for products with longer shelf lives made from peach palm fruit are a first step toward larger commercialization of peach palm fruit, as products like jarred, preserved fruit and peach palm flour could be exported to other areas.

Peach palm fruit has also been the subject of research by economic researchers in an attempt to give peach palm producers greater ability to sell their yield and profit off their production operations. However, these efforts have never come to pass on a global or even continental scale.[96] In the 1970s, the Brazilian *Instituto Nacional de Pesquisas da Amazônia* (INPA; National Institute of Amazonian Research) sought to support farmers with an interest in large-scale commercial peach palm production by creating a body of research geared toward

[92] Clement et al. 2004, 199-200.
[93] Clement et al. 2004, 200.
[94] Clement et al. 2004, 201.
[95] Clement et al. 2004, 201.
[96] Clement et al. 2004, 195.

peach palm development in a monoculture environment.[97] However, this approach ignored small-scale farmers who produce crops other than peach palm and thus have different growing requirements, so it never garnered much interest among actual peach palm producers.

Other national and international agricultural research bodies, including the International Center for Research in Agroforestry (ICRAF) and the Peruvian *Instituto Nacional de Investigación Agraria* (INIA; National Institute for Agricultural Research), have taken local farmers' preferences and needs into account when determining where to place their research efforts.[98] This approach led to a program which collaborates with local farmers to create peach palm fruit with the most idealized characteristics for farmers, which began in 1997.[99] The farmers who participated in providing seed for the initial trials owned the resulting seeds and could use them to improve the characteristics of their own crop, sell the seed, and create new products using the resulting fruit with idealized characteristics. The data from these trials was published in 2018 by ICRAF, and describe the morphological characteristics of the trees and fruit which resulted from the trials.[100] Trials such as these give small farmers the opportunity to customize peach palm seeds to consumer demand, and create particular yields for processing into peach palm products.[101] However, ICRAF does not list any ongoing projects related to similar trials in other locations, and the ICRAF/INIA program is the only program of this type discussed in published literature on peach palm economic and agricultural development.[102]

The biggest factor limiting robust peach palm development programs to promote better utilization and commercialization is budgetary constraints, as prior attempts to develop seed

[97] Clement et al. 2004, 202.
[98] Mora-Urpí et al. 1997, 61-2.
[99] Clement et al. 2004, 203.
[100] Cornelius et al., 2018. [Dataset]
[101] Cornelius et al. 2010, 33.
[102] http://www.worldagroforestry.org/region/LA/projects

banks for peach palm producers have failed because they are resource-intensive and serve a relatively small number of producers. Programs like the ICRAF/INIA program in Peru require fewer resources because they are less controlled and occur on local farms, and allow peach palm producers to garner a near-immediate benefit through use of fruit and seeds produced with desired characteristics. In the long-term, the data from this program may be put toward other development programs.

The existence of programs to develop the peach palm for large-scale commercial use in Latin America indicate that there is neither a strategically-developed ignorance nor a lack of knowledge that stems from unawareness of the peach palm. Instead, the lack of investment into these programs suggests that other crops have been prioritized higher than the peach palm, and thus overshadowed knowledge about the peach palm. As the next section will show, similar crops which also come from the New World have had different trajectories, both in their initial use by colonizing Europeans and in their more recent development.

Comparison with other New World crops

In nutritional profiles, the peach palm is frequently compared to other New World crops, described as having "twice the protein content of banana" and providing "more carbohydrate and protein per hectare than maize".[103] It is also closely compared with the sweet potato and cassava, as different peach palm varieties have near-identical average carbohydrate levels.[104] However, all varieties of peach palm have far more oil than cassava or sweet potato. Despite these nutritional similarities and advantages, each of these other crops has a global profile that the peach palm does not share. This section will compare the peach palm to two of these crops which are similar in nutritional value and can have similar usage as food products: sweet potato and manioc. Both

[103] NAS 1975, 73.
[104] Clement et al. 2004, 198.

of these crops are also native to South America and became global food staples as a result of European propagation.

The sweet potato,[105] *Ipomoea batatas*, is proposed to have originated between the Yucatan Peninsula in Mexico and the Orinoco River in Venezuela, though the oldest known remains of sweet potato were found in Peru.[106] Domestication may have occurred between Peru and Mexico, a significantly larger region than that of the proposed domestication of peach palm. Despite this difference, the sweet potato was also domesticated and dispersed throughout Central and South America at the time of European contact. Sweet potato was carried back to Europe on return from Columbus' first voyage in 1492, and by the 16th century, the Spanish and Portuguese were bringing sweet potato plants to various colonies and other locations around the world, though they notably were not the first to bring it to the Pacific Islands. Today, the sweet potato is bred to produce both the fresh food and several other products, including processed starch and alcohol.[107] Sweet potatoes have been the object of participatory plant breeding programs similar to the ICRAF/INIA program for the peach palm as well as programs using biotechnologies to improve breeding processes.[108] One of the objects of these breeding efforts is to increase the shelf life of harvested sweet potatoes.[109] While sweet potatoes are grown in large-scale commercial ventures, smallholders also produce them.[110]

The case of sweet potatoes differs from that of peach palm principally in that sweet potatoes were seemingly quickly selected to carry back to Europe on Columbus' initial voyage, and with subsequent voyages from the Americas, sweet potatoes continued to be carried to other

[105] Spanish: *batata*
[106] Lebot 2010, 98-101. (In *Root and tuber crops*, Bradshaw, J.E., ed.)
[107] Lebot 2010, 107. (In *Root and tuber crops*, Bradshaw, J.E., ed.)
[108] Lebot 2010, 111, 116-120. (In *Root and tuber crops*, Bradshaw, J.E., ed.)
[109] Lebot 2010, 107. (In *Root and tuber crops*, Bradshaw, J.E., ed.)
[110] Lebot 2010, 120-1. (In *Root and tuber crops*, Bradshaw, J.E., ed.)

European colonies and locations to which the Spanish and Portuguese traveled. However, it has also continued to see greater investment in successful breeding, with greater emphasis on idealizing seeds for farmers and use of new methods to further develop breeding processes. Several of the primary products made from sweet potatoes are similar to those of the peach palm, and it faces similar challenges to successful mass marketing, such as shelf life and necessary preparation before eating. It is not clear what caused the sweet potato to be brought back on the first voyage back to Europe after it was introduced to the Spanish, and the Spanish interest in the sweet potato may have been a chance occurrence. The quick introduction of the sweet potato to Europe appears to set into motion a trajectory for the sweet potato that sharply contrasts that of the peach palm, despite their similar characteristics.

Cassava,[111] *Manihot esculenta*, likely originated in Mexico or South America, and was domesticated in the lower Amazon region.[112] Though European colonizers were initially skeptical of foods like cassava, blaming it and maize for illnesses, these crops came to play a central role in their diets based on availability.[113] Slave traders initially avoided feeding ill or injured slaves cassava because they believed it might make them worse. However, by the end of the 16th century, cassava was brought to West Africa by European sailors, and a century later, to Asia by traders.[114] Around the world, cassava serves as a food staple and a feedstock for ethanol, and in sub-Saharan Africa, it plays a central role in creating and maintaining food security. Cassava can be processed into several food products which rely on its starch, such as tapioca and flour, its roots can be processed into animal feed, or, as is common in Amazonia, its tubers can

[111] also known as manioc in English; Spanish: *yuca*
[112] Schaal et al. 2006, 271, 278. (In *Darwin's harvest*, Motley, Zerega, & Cross, eds.)
[113] Earle 2012, 148.
[114] Ceballos et al. 2010, 58. (In *Root and tuber crops*, Bradshaw, J.E., ed.)

be fermented into alcoholic beverages.[115] Cassava also must be consumed or processed shortly after harvesting, because it will undergo post-harvest physiological deterioration.[116]

Unlike the sweet potato, cassava was underutilized until the 1990s, when globalization caused governments to take notice of its potential as both a highly productive food staple and material for industrial processes.[117] Breeding processes for cassava have also been assisted by biotechnological advances, such as tissue culture technologies, and resulted in plants better adapted for higher yield, lower cyanide levels, and resistance to pests and diseases.[118] However, participatory breeding programs have also been included in cassava development in order to breed for particular physical characteristics which are desirable for farmers and consumers.[119]

Cassava is more similar to the peach palm in that it was not so readily embraced by European colonizers as a food to carry outside the New World. Additionally, it was underutilized until very recently, and only now has begun to serve as a global crop, either for food or feedstock. Its nutritional profile has now been recognized as able to assist with the need for food security in sub-Saharan Africa, where it grows successfully. The recognition of cassava's potential has caused it to be the object of more rigorous and innovative breeding programs, which have resulted in more desirable characteristics and customizations for different uses. Though some literature acknowledges the peach palm as an underutilized crop, including a 1975 report by the National Academy of Sciences, there has been little action toward breeding programs using technologies available today which were not available in the past.[120] The products which can be made from the peach palm fruit are similar to those of cassava, including

[115] Ceballos et al. 2010, 66. (In *Root and tuber crops*, Bradshaw, J.E., ed.)
[116] Ceballos et al. 2010, 68. (In *Root and tuber crops*, Bradshaw, J.E., ed.)
[117] Ceballos et al. 2010, 67. (In *Root and tuber crops*, Bradshaw, J.E., ed.)
[118] Ceballos et al. 2010, 63. (In *Root and tuber crops*, Bradshaw, J.E., ed.)
[119] Ceballos et al. 2010, 67. (In *Root and tuber crops*, Bradshaw, J.E., ed.)
[120] NAS 1975, 73-80.

alcoholic beverages and flour, and the peach palm provides similar, if not greater nutritional content. Given that the peach palm could still be recognized as having potential similar to that of cassava, the peach palm may follow the trajectory of cassava.

Though not all characteristics of the sweet potato and cassava map accurately to the peach palm, these crops are similar enough to compare when in their respective histories they began to shift from regional crops, primarily used by those who live in the area, to global products. Cassava and sweet potato represent just two crops which have been prioritized higher than the peach palm, either by Europeans during the early years of colonialism in Latin America, or more recently by development programs which commercialize crops for food security or industrial uses. Cassava and sweet potato were not in direct comparison with the peach palm when they were selected and developed, but are representative of limited number of crops with potential to fill a particular need which are actually selected for use.

Historical accounts

The relationship between early European colonizers and the peach palm is uncertain, in part because of the diversity of terms and uses of the peach palm in South America. In some cases, European explorers may have encountered and written about the peach palm, but it may not be clear to contemporary researchers that colonizers who explored different regions were referring to the same plant. However, modern scholarship has identified many tentative, probable, and certain references to the peach palm in European accounts beginning from earliest contact into the colonial period.

V.M. Patiño (2002) writes an extensive history of the peach palm in different regions of Latin America, drawing largely on primary sources written by European explorers. Using these accounts along with linguistic data and biological work about peach palm dispersal, Patiño

interprets quotes from various accounts and places them in their geographic context in order to understand when they may refer to peach palm. Patiño argues that it is probable that Christopher Columbus encountered the peach palm on the coast of Costa Rica 1502 when he encountered weapons made from the wood, and the fruit he later describes in the same account which makes a wine may refer to peach palm fruit.[121] Patiño acknowledges that this reference, and others, may not always refer to peach palm, but rather a similar looking spiny palm. However, the number of references using consistent terminology for the region (which in some cases, is consistent with contemporary peach palm terminology for the area) suggests that many of the accounts quoted are true accounts of peach palm.[122] These accounts begin in the mid-16th century and extend through the colonial period, and often describe uses of peach palm fruit, palms, and wood in ways consistent with how they are used today.

The existence of these historical accounts beginning nearly at the time of European contact and extending through colonization suggest that the peach palm's lack of global propagation by European explorers was not an issue of unfamiliarity, or what Proctor calls "native state" ignorance.[123] These accounts recognize most of the major uses of the peach palm, indicating that at least some European explorers all over Central and South America were well aware of the peach palm's applications, but nonetheless, seemingly did not carry it to other parts of the world, or attempt to build up a commercialized production system in Latin America. The accounts do not give a sense of why Europeans would not have attempted to develop the peach palm, but their existence suggests that there was no intentional effort to conceal or ignore the

[121] Patiño 2002, 481.
[122] Patiño 2002, 483-496.
[123] Proctor 2008, 4.

peach palm. This historical context supports the proposal that the lack of peach palm development was a result of "selective choice" ignorance.[124]

Conclusions

Neither contemporary economic development nor early historical accounts fully explain the peach palm's lack of trajectory like that of cassava or sweet potato, or lack of significance outside of Latin America. Comparison with other crops does suggest that these similar crops may have taken hold by virtue of having been selected from many available crops. New World crops which have only remained regionally significant, including the peach palm, were simply not the preferred crop, or judged to be less valuable than others. Additionally, if ceremonial use and fermentation for alcoholic beverage-making were the primary reasons for peach palm spread and use in early Amazonia, that may indicate why colonizing Europeans did not carry the peach palm to other locations for use as a food staple.

Though cassava, which was initially not produced on a global scale, has become significant, others have not. The peach palm's lack of global significance compared to crops like cassava and sweet potato may also stem from practical growing considerations, which are not fully addressed in this chapter. The existence of *palmito* plantations outside South America suggests that the peach palm can grow in other environments, but it is possible that the time or labor investment required to grow and harvest peach palm fruit outweighs the benefits of its potential to serve as a nutritional staple globally. However, given the diversity of New World crops which today are globally known, it is likely that crops which require similar time and labor investments and growing conditions have become globally-produced and known. Additionally, the lack of regional large-scale peach palm production and support from agricultural

[124] Proctor 2008, 6.

development groups for large-scale local production suggests that even the first steps in ramping up peach palm production for global use have not yet taken place. These circumstances indicate a lack of interest and/or pressure to globalize the peach palm in a way similar to other New World crops.

The peach palm has not yet had its global moment, but that does not mean that it will not in the future. Much like cassava was not recognized as having the potential to fill global needs until the 1990s, the peach palm may also be recognized in the future, and could be developed for these purposes with additional resources and attention. Using concepts presented by Proctor and Schiebinger (2008), it is possible to understand global ignorance of the peach palm as an ignorance out of a lack of interest or desire to put resources into its development (a "selective choice"), rather than ignorance caused by unfamiliarity on the part of early European colonizers or by attempts to conceal or suppress the peach palm's existence. This supports the notion that there are few barriers to the peach palm's future development as a global product, despite its contemporary lack of global significance.

6. Conclusion

In its introduction, this paper proposed that one principal motivation of the peach palm's dispersal around South America was its use in making alcoholic beverages, and the associated ceremonial culture. This project also suggested that Arawakan speakers may have played a significant role in spreading the peach palm to its contemporary distribution. Linguistic and ethnographic evidence support both of these arguments, and each give insight into the other.

Given that a peach palm term reconstructs for the southern branch and a major portion of the northern branch of Arawakan, it is likely that the peach palm became salient for many Arawakan speakers at least prior to the breakup of Proto-Southern Arawakan and Proto-Northern Inland Arawakan into their respective daughter languages. However, given that the peach palm terms could have changed or have been replaced in other or both of these protolanguages at the time they were spoken, there is not evidence to say that the peach palm was unknown to speakers of Proto-Arawakan, or that there was not once a single term for peach palm that comes from Proto-Arawakan. Additionally, because a number of unrelated languages in a nearby geographic area appear to use Arawakan loanwords to refer to the peach palm (either directly or indirectly loaned from Arawakan), it is probable that speakers of at least some of these languages were introduced to the peach palm by Arawakan speakers. Finally, the tradition of fermenting peach palm fruit to make beer appears to have been dispersed around northern and western Amazonia as well, also possibly led or mediated by Arawakan speakers.

In addition to the likely central role of Arawakan speakers in peach palm dispersal, the reconstructed Proto-Southern Arawakan peach palm term *kawɨ[rɨ] may come from the Proto-Tupi-Guarani term for 'fermented drink', suggesting that Proto-Southern Arawakan speakers may have been in contact with Proto-Tupi-Guarani or Proto-Tupi speakers in the region where

the peach palm was domesticated, and that perhaps Proto-Southern-Arawakan speakers were introduced to fermented peach palm drinks by speakers of some Proto-Tupian language. While there may be other explanations for the relationship between these terms, given other evidence presented in this project regarding the relationship between peach palm spread and beer-making, the Proto-Tupi-Guarani term strongly suggests some Tupian role in early peach palm dispersal, in addition to the later role previously discussed in this project.

The patterns of reconstructions and loanwords also correlates with the paths of domesticated peach palm dispersal proposed by Clement et al. (2017). In the west, reconstructions suggest that Arawakan speakers may have been one group which was carrying the peach palm northwest along the upper Ucayali River basin, and in the east, Tupian or Tupi-Guarani speakers may have contributed significantly to the dispersal along the Madeira river to the northeast. While peach palm terms reconstruct in families other than Arawakan and Tupian, the contemporary geographic distribution of the languages in these families correspond roughly to the major directions of peach palm dispersal, and instances of loanwords sourced from both families have been identified.

The early uses of the peach palm, like fermentation, have persisted today, and though some efforts to commercialize peach palm fruit and *palmito* production have been made, it remains primarily a regionally-relevant food, with the greatest social significance in indigenous communities. The evidence presented earlier in this project suggest the peach palm has not yet become a global food staple because its initial reason for dispersal and use related to ceremonial culture, rather than food supply. Though the peach palm may not primarily fill subsistence needs in indigenous communities, nutritional and economic research has shown that it could fill food security needs around the world, as it provides similar nutritional value as other New World

crops like sweet potato and cassava, which have similar roles today. The peach palm could have multiple uses globally, as an element of cultural traditions in communities where it currently serves that purpose, as a food staple to bolster food security, and as the basis of value-added products like *palmito*, peach palm flour, and others.

Studies like this one have been published for other crops, especially those native to South America, and together, they form a body of work which gives insight into the patterns of migration and interaction among pre-Columbian people in South America. The trajectories of these different crops often cross-cut one another, sometimes moving in opposite directions as they become more dispersed around a geographic area. This may be representative of the trade networks and patterns of migration which were in place in South America at this time, with certain crops moving in one direction via those who carried it, and other useful crops moving in opposite or different ways. Future scholarship on these crops might consider the trajectories of distribution of these crops with respect to one another, highlighting crops whose spread might be primarily or partially attributed to speakers of particular languages. The insights gained from this kind of work are always tentative, and unlikely to reveal a comprehensive history, but they can create more accurate approximations and possible patterns of movement and interaction that involves useful, widespread crops like the peach palm.

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